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STRANGE STORIES

OF

THE ANIMAL WORLD.

A BOOK OF
CURIOUS CONTRIBUTIONS TO NATURAL HISTORY.

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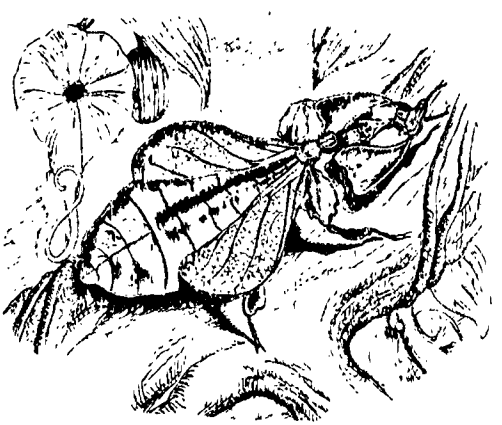
BY

JOHN TIMBS,
AUTHOR OF "THINGS NOT GENERALLY KNOWN," ETC.



THE LEAF INSECT, OR WALKING LEAF.—*See p. 130.*

With Illustrations.

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PREFACE.

The popularity of Natural Wonders, more especially those of the Animal World, is fully attested in the hundreds of volumes which have been produced upon this class of objects, for the gratification of every age. We have all, from observation, some knowledge of natural objects, which acquaintance we are ever seeking to extend; and this passion is evident in most of us—from the child with its picture-book and game of "birds, beasts, and fishes," to the learned Professor whose life is devoted to the extension of the bounds of natural science.

The interest attached to the objects in this wide field is exhaustless as animated Nature itself. Travellers and naturalists are ever adding to this intellectual store; and our libraries, museums, and cabinets are ever being enriched by the fruits of their enterprise and observation.

Of such attractive materials is the staple of the present volume, which, by aid of the arts of selection and condensation, the Author has endeavoured to render comprehensive, acceptable to all grades of readers—in short, to render his "Strange Stories," a book for old and young.

Another of its aims has been to present wonders free from that love of exaggeration which besets narratives of Natural History, the facts of which are in themselves sufficient to "excite our special wonder." And, throughout the volume, in recording experiences and novelties, acknowledgment of authorities of which the Author has availed himself, has been his constant rule and practice.

A glance at the annexed Table of Contents will convey some idea of the variety of information sought to be con-

veyed in the present volume, which, be it added, is not intended for systematic study so much as for vivid narratives of the habits of Animals, their instincts and reasonings, which are generally welcome to the inquiring reader, who seeks information combined with entertainment.

To Animals, their Characteristics and Ages are devoted two sections. "Life in the Sea" is intended to familiarize the reader with the wonderful order and arrangement of organic life in its depths, which has of late years received so much illustration from naturalists. To the next Section the Insect World contributes Marvels. Next are curious narratives of Serpent-life. Then, the science of Electric Fishes. In the "Life of the Gorilla" are focused most of what is known respecting that anthropoid ape. In the Sections devoted to the Beaver, the Camel, and the Whale, the exaggerations and foolish notions have not been spared. In the Chapters on the "Big Bird of New Zealand," and the Dodo, the question of extinct animals is familiarly explained. The volume concludes with Popular Errors respecting Animals, anecdotically illustrated.

An admirable writer has said: "Do not depreciate any pursuit which leads men to contemplate the works of the Creator. The Linnæan traveller, who, when you look over the pages of his journal, seems to you a mere botanist [or a zoologist] has in his pursuit, as you have in yours, an object that occupies his time, and fills his mind, and satisfies his heart. It is as innocent as yours, perhaps more so; because it is not so ambitious. Nor is the pleasure which he takes in investigating the structure of a plant [or animal] less pure, or less worthy, than that you derive from perusing the noblest production of human genius." This excellent sentiment will, it is hoped, propitiate a favourable reception for the present volume of "Strange Stories."

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STRANGE STORIES

OF THE

ANIMAL WORLD.

I.

CHARACTERISTICS OF ANIMAL LIFE.

NEARLY a score of years ago, the number of species of living animals was computed at half a million, and the number of fossil species at the same number. This estimate appeared in the *Principles of Zoology*, by MM. Agassiz and A. A. Gould. Its numbers were, however, considered to be under the mark: the Birds, for example, were set down at 6000, whereas they are certainly more numerous, and, probably, amount to 8000 species; and the Molluscs, which are set down at 15,000, certainly exceed 20,000. Such numbers are, therefore, but approximations, which the discoveries of every year are placing more and more beyond the pale of probability.

The Geographical Distribution of Animals, or why certain Animals belong to certain countries, is an inquiry of more positive interest than their number. Viewed in connexion with the progress of human civilization, Dr. Ogilvie, the dis-

tinguished naturalist, points to the less civilized nations of the world as being so from the absence of animals capable of domestication. Thus, if we examine the facilities which the natives of Europe, Asia, and Africa possessed for civilization, compared with those of America and Australia, we shall find that the former had those great co-operators in their social progress, namely, the horse, the ass, and the camel, for beasts of burden; and they had the sheep, the ox, and the goat, for food and a thousand other useful purposes. The consequence of this was, that at a very early period,—a period of which there are few authentic historical documents extant—the nations of Western Asia had advanced in civilization to an extent which is now only beginning to be thoroughly understood and appreciated. The researches of Layard into the antiquity of Assyria and Egypt prove this beyond question, and show that those nations had advanced to a power, which, in modern times, has scarcely been equalled; and that we are only now in the same state with regard to civilization, that they were three or four thousand years ago.

In illustration of the distribution of animals as connected with climate, which has been ably enforced by Professor Agassiz, it may be mentioned that four hundred species of Molluscs have been found in a small part of the island of Jamaica in a few weeks; and that one-fourth of these are land-shells, of which new species were found by the collector with every ten miles travel. As a remarkable example of the difference of *station* of different species, a small salt-pond in the peninsula of Port Royal is described, in which *Cerithium*, a spiral shell, occurred very abundantly from the margin to eighteen inches' depth, where another species of *Cerithium* commences, and extends to three feet in depth: although the

two species approximate to contact at the zone of eighteen inches in depth, they do not intermingle.

Temperature is shown to be the governing principle of the distribution of marine animals. Thus, we have a climate represented in marine depth as in terrestrial elevation; and it appears that density in depth is not so unfavourable to the existence of animal life as is generally supposed. Admiral Sir Edward Belcher has always found the mud, or bottom of the sea, of the same temperature as the water directly above it: he has seen fish brought up from a depth of 150 fathoms, (900 feet;) and in clear water, the sea bottom has been seen at a depth of 33 fathoms (198 feet). Professor Edward Forbes states that animals brought up from a depth of 270 fathoms, (1620 feet,) lived very well in water on the deck of a vessel; thus showing that pressure has little to do with their existence. The inference that light penetrates to great depths in the ocean is founded on the existence of colour in plants at the above great depths. As a proof that the influence of temperature is very great, it is stated that entirely different animals and plants exist in the Gulf Stream to those which exist on its borders. Indeed, it appears that adaptation to pressure is speedily effected in animals. Dr. Carpenter explains that they differ in their power of bearing pressure. The condor, in descending from its flight, frequently passes through three miles of atmosphere in a few moments. The whale is said to go from the surface to a depth of 1000 fathoms, or more than a mile and one-sixth.

One of the grand results shown by the naturalists of the United States Exploring Expedition of 1848 was this fact illustrative of distribution. The Land Shells of the islands of the Pacific Ocean are entirely different in different islands;

each island appearing to have a species of shell peculiar to its own formation. These shells could not, it is stated, have been derived from the Continent, but must have originated in the respective islands where they are found.

In the Polar Regions we find some remarkable instances of distribution. Here, not only is there an uninterrupted development of active microscopic life, where larger animals can no longer exist, but we find that the microscopic animals collected in the Antarctic Expedition of Captain James Ross, exhibit a remarkable abundance of unknown and often most beautiful forms. Even in the residuum obtained from the melted ice, swimming about in round fragments, in the latitude of 70° 10′, there were found upwards of fifty species of siliceous-shelled Infusorial animalcules with their green ovaries, and therefore living and able to resist the extreme severity of the cold. In the Gulf of Erebus, 68 of the above siliceous-shelled animated atoms, and only one calcareous-shelled, were brought up by lead sunk to a depth of from 1242 to 1620 feet.

Sometimes distribution is effected by fortuitous agency. An insect was sent to Professor Haldeman from Rio by Dr. Reinhardt, with information that this, or an allied species, had been seen by him on board the United States ship, *Constitution*, in Cochin China, and subsequently in all the ports of the Pacific—the ship touching at the Sandwich Islands and Western Mexico, and passing Cape Horn and Brazil, a wider geographical distribution than had been heretofore given to this genus. The insect proved to be an *Evania*, and its extensive distribution is attributable to the fact that, this family is parasitic on the *Blatta*, (or cockroach,) which is known to be extensively abundant upon ships between the tropics.

The Classification of the Animal Kingdom with reference to the structure of animals, and their functions, was worked out, nearly at the same time by Cuvier and Bichat. In 1795, Cuvier laid down the great principle, that the study and classification of animals was to be, not as heretofore, with a view to external peculiarities, but with a view to internal organization; and that, therefore, no real advance could be made in our knowledge except by extending the boundaries of Comparative Anatomy. The discovery of Bichat consists of the striking fact that the teeth of each animal have a necessary connexion with the entire organization of its frame; so that, within certain limits, we can predict the organization by examining the tooth. This beautiful instance of the regularity of the operations of nature was not known until more than thirty years after the death of Bichat, and it is evidently due to the prosecution of that method which he sedulously inculcated. For the teeth, never having been properly examined in regard to their separate tissues, it was believed that they were essentially devoid of structure, or, as some thought, were simply a fibrous texture. But by minute microscopic investigation, it has been recently ascertained that the tissues of the tooth are strictly analogous to those of other parts of the body; and that the ivory, or dentine, as it is now called, is highly organized; that it, as well as the enamel, is cellular, and is, in fact, a development of the living pulp. This discovery, which, to the philosophic anatomist, is pregnant with meaning, was made about 1838; and though the preliminary steps were taken by Purkinjé, Retzius, and Schwann, the principal merit is due to Nasmyth and Owen, between whom it is disputed.

The discovery is similar to that which we owe to Agassiz;

similar in the method by which it is worked out, and also in the results which have followed from it. Both are due to a recognition of the fundamental maxim of Bichat, that the study of organs must be subordinate to the study of tissues, and both have supplied the most valuable aid to Zoological classification. On this point the service rendered by Owen is incontestable. This eminent naturalist has, with immense industry, applied the discovery to all vertebrate animals; and in an elaborate work, specially devoted to the subject, he has placed beyond dispute the astonishing fact, that the structure of a single tooth is a criterion of the nature and organization of the species to which it belongs.*

How the vegetable kingdom supplies the materials out of which the animal body is constructed, has been thus lucidly explained: "In no particular is the distinction between the two great kingdoms of organic life more strong than in this, that the plant makes organic compounds, which the animal turns to its own account, and, in doing so, unmakes. It is for the use of the animal that certain plants generate such quantities of albuminous substances as can be turned to no conceivable account in their own economy." When applied to the construction of the several tissues of the animal fabric, especially the muscular and nervous, these substances become subservient to motion and sensation. Each of these phenomena of animal life, however, essentially involves the restoration of a certain portion of organized tissue to the condition of inert matter. Death and decay are thus always going on within the animal body, the more rapidly as its life is more energetic; and hence, while its sustentation requires a continually renewed supply of food, its healthful

* Buckle's History of Civilization in England, vol. i. pp. 817—819.

state can only be maintained by its useless particles being got rid of by certain processes, of which respiration is the most important; and whatever may be the form in which the excretory product leaves the body, they all resolve themselves ultimately,—as does the body itself, when at last nature claims her debt,—into water, carbonic acid, and ammonia.

"The wonderful cycle of organic life in which the constituents of the atmosphere are thus made to pass through one living body after another, and are at last restored to it in their pristine state, is now presented on a small scale to the observation of every one in the aquaria which are the fashionable ornaments of our drawing-rooms, and are affording an object of healthful interest to many who scarcely come into direct contact with nature in any other way. Every self-sustaining aquarium ought to include three kinds of living beings, namely, plants, vegetable-feeding animals, and carnivorous animals: thus, in a freshwater tank we may have *vallisneria*, water-snails, and gold-fish; in a marine tank, some of the grass-green seaweeds, anemones, phytophagous gasteropods, and blennies or gobies. The plants will thrive in sunlight on the carbonic acid and ammonia diffused through the water; the anemones and the molluscs will support themselves on the vegetable diet thus prepared for them; their eggs and young serve to sustain the predacious fish; and while the plants are continually imparting fresh oxygen to the atmosphere of the tank, this is as constantly consumed by its animal inhabitants, which are restoring to the water, during their whole lives, the carbonic acid and ammonia of which the plants deprived it." *

The Mechanism of Animal Locomotion has been minutely

* National Review, No. 8, p. 363.

illustrated. Professor Marshall, in 1863, described, at the Royal Institution, by aid of models and diagrams, the columns of support, the joints, and their accompanying muscles, the position of the centre of gravity, and the means of maintaining equilibrium in the acts of standing, sitting, walking, running, and leaping. Especial attention was directed to the atmospheric pressure on the joints, amounting, in the knee, where so much flexibility is required, to 60 lbs., and in the hip-joint to 28 lbs. The following were given by Professor Marshall as rates of locomotion per hour: shark and salmon, 16 and 17 miles; flies, 4 to 6 miles; worms, 30 feet; race-horse, 40 to 60 miles; man—walking, 4 to 5 miles—running, 12 to 15 miles.

The velocity of a horse in walking is estimated at $5\frac{1}{2}$ feet per second, or $3\frac{3}{4}$ miles per hour; in trotting, 12 feet per second, or $8\frac{1}{5}$ miles an hour; and in galloping, 18 feet per second, or $12\frac{1}{4}$ miles per hour.

Mr. J. F. Herring, sen., the celebrated animal painter, states that a race-horse will clear from 20 to 24 feet at a bound; and from the impression left on the turf, he infers that a horse at full gallop places only one foot at a time upon the ground. This, he says, is more convincing to the ear than to the eye. In listening to a horse galloping on a hard road, it will be found accurately exhibited by placing the little finger on a table or pane of glass, and causing the other three fingers to follow in rotation; by so doing, the precise sound of that of a horse galloping will be produced. Then follows the bound, and again the 1, 2, 3, 4, in regular succession; or, as Virgil gives it, in his imitative line:

> Quadrupedante putrem sonitu quatit ungula campum.
>
> *Æneid*, viii. 596.

Dr. Fleming, in his valuable *Philosophy of Zoology*, has these interesting data of the Flight of Birds. "Hawks and many other birds, probably, fly at the rate of 150 miles an hour; an eider-duck at 90 miles an hour. Sir George Cayley computes the common crow to fly at nearly 25 miles an hour. Spallanzani found the rate of the swallow at about 92 miles an hour; while he computes the rapidity of the swift to be nearly three times greater. A falcon, which belonged to Henry IV. of France, escaped from Fontainebleau, and in 24 hours after was found at Malta, a distance of not less than 1530 miles; a velocity nearly equal to 57 miles an hour, supposing the falcon to have been unceasingly on the wing. But as such birds never fly by night, and allowing the day to be at the longest, his flight was, perhaps, equal to 75 miles an hour. If we even restrict the migratory flights of birds to 50 miles an hour, how easily can they perform their most extensive migrations! Fair winds may, perhaps, aid them at the rate of 30 or 40 miles an hour; nay, with three times greater rapidity."

Hayley has left these impressive lines on the migration of swallows:

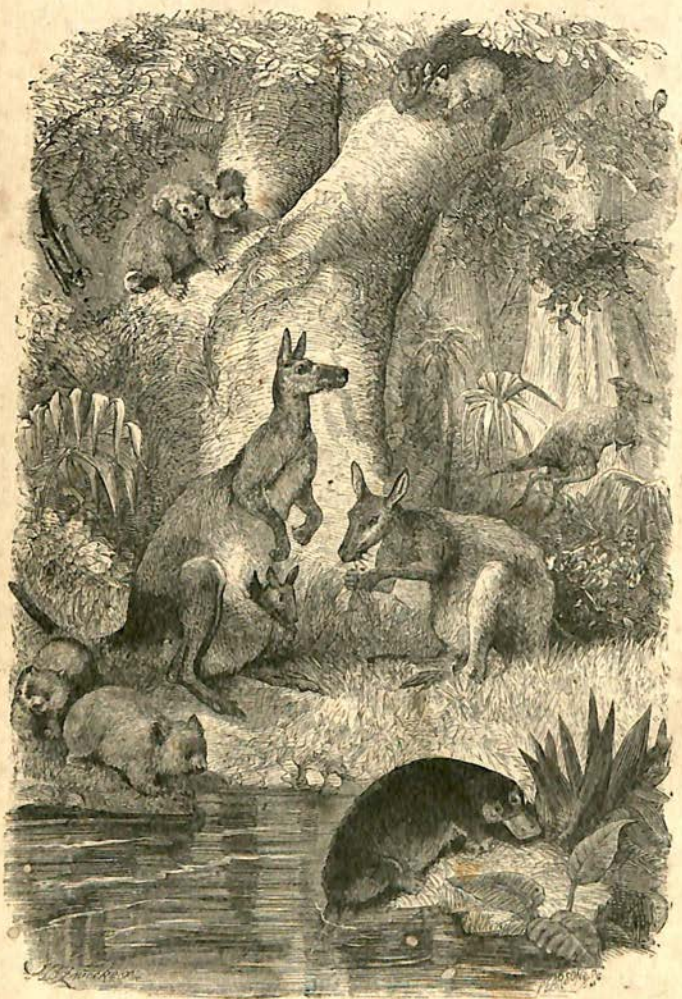
> Ye gentle birds, that perch aloof,
> And smooth your pinions on my roof,
> Preparing for departure hence,
> Ere Winter's angry threats commence;
> Like you, my soul would smooth her plume
> For longer flights beyond the tomb.
> May God, by whom is seen and heard
> Departing man and wand'ring bird,
> In mercy mark me for His own,
> And guide me to the land unknown!

The above comparison by Dr. Fleming of the velocity of the swallow and the swift, we find thus amplified by another

writer on Natural History: "Few birds pass over so great an extent of surface, in the same time, as the swallow, who flies in the usual way at the rate of a mile in a minute, and is thus engaged, without apparent fatigue, during 10 or 12 hours every day, as ascertained by Wilson, the ornithologist. Swallows have been employed to carry letters as pigeons were some years back; but the results were uncertain. There is one little bird, however, the swift, which appears to excel all others in the rapidity of its movements. An eminent naturalist, who has assiduously studied the habits of this bird, estimates its motions as being equal to 250 miles an hour. It eats, drinks, and collects materials for its nest on the wing; living in the air more than any other bird, and performing all its functions there, excepting those of sleep and incubation."

Thus, we see that the speed of a bird's flight is not equalled by the fastest railway train, which is little more than half the velocity of the Golden Eagle, estimated to pass through the air at the rate of 140 miles an hour. Birds surpass all other animals, not only in reference to the rapidity of their movements, but also for continuing them for a long time without taking food or rest. It is well ascertained that land-birds cross vast tracts of ocean; flying at a rate equal to 50 or 60 miles an hour, and keeping on their course both by day and night. The *Blue Birds* of America, in their periodical migrations, are frequently seen in situations where a distance equal to 600 miles interposes between them and the nearest point of land from which they had taken their flight.

Certain Birds change in their plumage, from a dark colour to white, in winter. Then the Ptarmigan is invariably found white, like the Alpine Hare and Stoat; although, on the



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AUSTRALIAN ANIMALS:

Flying Squirrel. Koala. Vulpine Opossum. Kangaroos. Wallaby. Wombat
Ornithorhynchus.

return of spring and throughout the summer, it exhibits principally a grey and dusky attire. With many of our waterfowl, entire or partial changes of the same kind take place. Mr. Gould notices one or two instances of a somewhat similar change among the birds of Australia, as in the Hoary-headed Grebe. The change takes place sooner when the winter sets in early, while a prolonged winter occasions an equally corresponding continuance of the white dress.

Different land and water birds exhibit this periodical change, respecting which, very mistaken notions appear to prevail. The physiologist, assuming that feathers, after their full development, do not derive any nourishment from the animal, an opinion which many circumstances demonstrate to be erroneous, have referred the changes to the natural decay of the feathers, or to a change of feathers by moulting. The metaphysician, on the other hand, conjectures that birds become white in winter "to render themselves less conspicuous among the snow," and thus escape the penetrating eye of their foes. But such speculators should consider that HE who created these birds, and destined them to undergo their periodical changes of colour, likewise created the predacious birds; that both are equally the objects of HIS care, and that the compensations regulating the supply and demand which exist in the economy of nature, are of a very different kind from all such as would secure the protection of one species at the cost of starvation in another. Had due attention been paid to the succession of colouring, in reference to the periods of the year, and to the different radiating powers of light and dark-coloured dresses, the following conclusion would, probably, have been deduced—that, like the increase of quantity, the change to the white colour at the

beginning of winter, was an arrangement destined to maintain the temperature of the body, by preventing radiation during the continuance of the cold season.*

The variously-tinted and mottled Eggs of Birds are objects of much interest to the collector; and in their diversity of colour, nature has some final end in view. It is maintained that of those birds whose nests are the most liable to discovery, and whose eggs are most exposed to observation from the form of the nests, the eggs are of that colour which is the least different from the surrounding objects; whilst those birds whose eggs are of a bright and positive colour, hide their nests in the hollows of trees, or never quit them excepting in the night, or sit immediately that they have laid one or two eggs. M. Gloger, a German naturalist, has published an elaborate memoir on this interesting subject. In support of his theory he mentions that the birds which lay an egg perfectly white (the most attractive), make their nests in holes of the earth, and cavities of trees, such as the kingfisher and the woodpecker, or construct them with a very narrow opening, as the domestic swallow; that the same coloured egg is found amongst the birds which scarcely quit their nests in the day, as hawks and owls; and that such birds as doves, which only lay one or two eggs, and sit immediately after, have their eggs white. The bright blue or bright green egg belongs to birds which make their nests in holes, as the starling; or construct them of green moss, or place them in the midst of grass, but always well covered. The eggs of many gallinaceous birds, that make their nests carelessly in the grass, are of a pale and less decided green, such as those of the partridge and pheasant. Of the mixed

* North British Review, No. 2.

coloured eggs, those of which white forms the ground belong to birds that make very close nests. Speckled eggs, with a dark or dirty ground, belong to the largest number of species. Almost all the song-birds lay such eggs; and, building open nests, they almost invariably line the inside of them with materials of the harmonious colour of the eggs, so that no evident contrast is presented which would lead to their destruction. Though not in every instance, yet in many, we certainly see a design in the adaptation of the colours to the purpose of concealment, according to the habits of the various classes of birds.

The Nests of Birds are of such various form and materials as to exceed our limit. One of the most curious, as exemplifying what Colonel Thompson calls "mechanical knowledge," is the Tailor Bird's nest in tropical countries. The Colonel has taken a Tailor Bird's nest out of a hedge in India, and its structure is thus described: The bird fastens together two or more leaves of suitable size with cotton, to contain its nest. But it does not sow them with a continuous thread: it puts the cotton through both, and then forms a knob at each end; so that, in fact, it *rivets* them. The beak performs the office of drilling in the leaves the necessary holes, and passing the fibres through them with the dexterity of a tailor. Even such parts in the rear as are not sufficiently firm are sewed. This bird inhabits India, particularly Ceylon. Among the curious nests in the British Museum are two specimens of the arbours of twigs formed by two species of Australian Bower Birds; one ornamented with bones and fresh-water shells, and the other with feathers and land-shells.

Of instinct, or reason, in birds, of which Prior sang—

> Instinct and reason how can we divide,

remarkable instances are related, as in the "Crows' Court,"

which extraordinary assembly is observed in the Feroe islands, the Scotch isles, &c. The Crows there collect in great numbers, as if they had all been summoned for the occasion. A few of the flock sit with drooping heads; others seem as grave as if they were judges, and some are exceedingly active and noisy: in the course of about an hour, the company disperse, and it is not uncommon, after they have flown away, to find one or two left dead on the spot. Dr. Edmonston, in his view of the Zetland islands, says that sometimes the meeting does not appear to be complete before the expiration of a day or two, Crows coming from all quarters to the session. As soon as they are all arrived, a very general noise ensues, and shortly after the whole fall upon one or two individuals, and put them to death; when this execution has been performed, they quietly disperse. The Crows in Feroe feed upon shell-fish, which they let fall on the rocks from a considerable height. Necessity has made them omnivorous. They will even enter houses where persons are sitting, in search of prey.

Of Birds deceived by Paintings there is a curious story in ancient history, of some Fruit having been painted by Zeuxis, by which birds were so deceived that they pecked at the fruit. This has been doubted; but Sir W. Trevelyan explains it by the inference that the fruit was not well painted, and that the birds were attracted only by the bright spots of colour in the picture. The Blackbird, the Turkey, and some other birds, are known to be partial to red: a Blackbird has been known to pick off all the red daisies from a flower-border, but leave the other colours undisturbed. A species of insect, (*Thrips urticæ*) has been noticed as particularly attached to yellow flowers, as nasturtium, ranunculus, &c.

Swainson, in his Zoological Illustrations, describes the *Trichoglossis Swainsoni*, a beautiful bird of Australia, which feeds on the honey it obtains from the blossoms of the Eucalyptus tree. He says that "a tame bird, on being shown the coloured drawing of a native plant, tried to suck the flowers, and it even made the same attempt with a piece of cotton furniture. I have seen an insect in the same way deceived by bright spots of colour. In a room rudely stencilled with imitations of bright-coloured flowers, I saw the moth of the *Sphinx convoluti* repeatedly fly along the wall, and dart at every bright spot of colour, as if taking it for a real flower." More anecdotes would also tend to show, that some animals are guided to their food more by sight than by scent.

Birds of prey float, as it were, without any effort, and with steady expanded wings, at great heights in the atmosphere. This they are stated to do by means of the quantity of air contained in the air-cells of their bodies, which air being taken in at a low level, in the atmosphere, of course rarifies and expands, as the bird ascends into the higher regions. Their rapidity of descent must be accomplished by the sudden expulsion of this air, aided by their muscular efforts. It is, however, an error to suppose that all Birds have their bones thus filled with air, to give them buoyancy; for it has been proved to the Zoological Society by Dr. Crisp, that of 52 British Birds dissected by him, only one, the sparrow-hawk, had the bones generally perforated for the admission of air. In thirteen others, the *humeri* only were hollow, and among these were several birds of short flight. In the remaining 38 neither *humeri* nor *femora* contained air, although in the list were several birds of passage and of rapid flight. Here is another view of the subject.

Dr. John Davy, as the result of a series of observations, remarks that "the specific gravity of the body of birds is concerned but in a very subordinate manner with their aptitude for aerial locomotion. Their fitness seems to depend on other circumstances, such as the great lightness of their feathers, owing to the air which they contain; the little tendency of water to adhere to them when exposed to rain; their form and arrangement, so admirably adapted for the purpose of impulse; the high temperature of the body expanding the contained air; and the immensely powerful muscles, the pectoral, belonging to the wings." Dr. Davy then asks: "Is not the power of flight of each species in a great measure proportional to these conditions?"

Of all birds, the Condor mounts the highest into the atmosphere. Humboldt describes the flight of this bird in the Andes to be at least 20,000 feet above the level of the sea. From the cave of Antisana, elevated 12,958 feet above the level of the Pacific Ocean, he saw a Condor soaring at a perpendicular height of 6876 feet. It is a remarkable circumstance, says he, that this bird, which for hours continues to fly about in regions where the air is so rarified, all at once descends to the edge of the sea, and thus in a few minutes passes through all the varieties of climate. Many years ago, Ulloa expressed his astonishment that the Vulture of the Andes could fly at a height where the mean pressure of the air is only fourteen inches. It was then imagined, from experiments made with the air-pump, that no animal could live in so rare a medium; but Humboldt had seen the barometer on Chimborazo fall to thirteen inches eleven lines; and Guy Lussac respired for a quarter of an hour in an atmosphere whose pressure was even less than this. At these heights,

man generally finds himself reduced to a painful state of debility, while the Condor, on the contrary, appears to breathe freely. Of all living beings, this appears to be the one that can rise at will to the greatest distance from the earth's surface. Occasionally, small insects are carried involuntarily even higher by ascending currents of air.

The power of Pigeons on the wing is proverbial. In 1850, on October 6, Sir John Ross despatched a pair of young Pigeons from Assistance Bay, a little west of Wellington Sound; and on October 13, a Pigeon made its appearance at the dovecot in Ayrshire, in Scotland, from whence Sir John had the two pairs of Pigeons which he took out. The distance direct between the two places is about 2000 miles.

Mr. Yarrell tells us that the dovecot was under repair at this time, and the Pigeons belonging to it had been removed; but the servants of the house were struck with the appearance and motions of this stranger. After a short stay it went to the pigeon-house of a neighbouring proprietor, where it was caught, and sent back to the lady who originally owned it. She at once recognised it as one of those which she had given to Sir John Ross; but to put the matter to the test, it was carried into the pigeon-house, when out of many niches it directly went to the one in which it had been hatched. No doubt remained in the mind of the lady of the identity of the bird.

This remarkable variety, called "the Carrier Pigeon," before the electric telegraph came into operation, carried many a message to and from distant parts with great rapidity. Some specimens, when well trained, used to fetch large prices. Speculators in the Funds got the earliest intelligence by these airy couriers. They were trained for the

purpose, in establishments formed for them on both sides of the Channel, where trusty persons were kept, to despatch the pigeon messengers, and to receive them; and to maintain a pigeon express cost from 600*l.* to 700*l.* a-year, which may be imagined when it is taken into account that, in case some of the birds might be shot in their passage, a flock of eight or a dozen were started together. The messages were in a short-hand, or hieroglyph, known only to the pigeon-man. The carrier-pigeon is now eclipsed by the electric telegraph; but the bird is still occasionally used.

Colonel Thompson, in relating some amusing instances of "the Mechanical Knowledge of Animals," remarks that "Wild Geese show tactical knowledge in their mode of flight, It is not correct to say that when there are only three or four birds, they fly in a straight line, one after the other; nor that when more numerous, they assume a wedge-shaped form because angular forms diminish atmospheric resistance. What they do is, in all cases, on one and the same principle. They are anxious to be as close to one another as they can, and for this purpose to make the best stowage of their long necks and legs. This they accomplish by every bird after the first sailing upon what a sailor would call his neighbour's 'quarter.' This throws the general line into an inclination of perhaps two points, or the fourth part of a right angle, with the wake of each bird; the whole resembling the position of a fleet which, after being formed upon a wind in line of battle astern, has tacked together by signal. And when it happens that a line is formed on both quarters of a particular bird, there arises the form like the letter V; with other transformations on the same principle, which may be observed when the birds are induced to make sudden changes in their

array." This is also the practice of swans, ducks, and geese, in swimming; and, the fact that the bird in the van is successively relieved by those in the rear, points out that the leader's efforts are greater than those behind, and require in this way to be relieved.

Domestication produces certain variations in animals, which are very striking: probably in no instance is this more remarkable than in the variations produced in the Dog, because that animal is most completely under the subjection of man; and dogs, having been transported by mankind into every part of the world, have submitted their actions to his entire direction. "Regulated," says Cuvier, "in their breeding by the pleasure or caprice of their masters, the almost endless variety of dogs differs from each other in colour; in length and abundance of hair, which is sometimes entirely wanting; in their natural instincts; in size, which varies in measure as one to five; amounting, in some instances, to more than an hundredfold in bulk; in the form of their ears, noses, and tails; in the relative lengths of their legs; in the progressive development of the brain, in several of the domesticated varieties, occasioning alterations even in the form of the head —some of them having flat, long slender muzzles with a flat forehead, others having short muzzles, with the forehead convex, &c.; insomuch that the apparent differences between a mastiff and a water-spaniel, and between a greyhound and a pug-dog, are even more striking than between almost any of the wild species of a genus.

"Finally, and this may be considered as the maximum of the known variation in the animal kingdom, some races of dogs have an additional claw on each hind-foot, with corresponding bones of the tarsus or instep; as there sometimes

occur in the human species, some families that have six fingers on each hand. Yet, in all these varieties, the relations of the bones with each other remain essentially the same, and the form of the teeth never perceptibly changes, except that in some individuals one additional false grinder occasionally appears, sometimes on the one side, and sometimes on the other."

Among the effects of domestication in Dogs is their *barking*. The Australian Dog never barks: indeed, Gardiner, in his *Music of Nature*, asserts that "dogs in a state of nature never bark; they simply whine, howl, and growl; this explosive noise (the bark,) is only found among those which are domesticated." Sonnini speaks of the shepherd's dog in the wilds of Egypt as not having this faculty; and Columbus found the Dogs which he had previously carried to America to have lost their propensity to *barking*. This is an acquired faculty —an effort to speak, which the Dog derives from his association with man. Indeed, the Dog is declared to have been brought to speak: Leibnitz bears witness to a hound, in Saxony, that could speak distinctly thirty words. The Dog, too, is the only animal that dreams.

Every one has observed that Dogs, before they lie down, turn themselves round and round several times. Those who have had an opportunity of witnessing the actions of animals in a wild state, know that they seek long grass for their beds, which they beat down, and render more commodious by turning round in it several times. This observation is due to Mr. Jesse, in his *Gleanings:* he adds, in explanation: "it would appear, therefore, that the habit of our domestic dogs in this respect is derived from the nature of the same species in the wild state. This is a curious fact, and serves to prove

how much the instinctive habits of wild animals are retained by their domesticated progeny."

There is a chapter in one of our metaphysical writers, showing how Dogs make syllogisms, or forms of reasoning in which the conclusion necessarily follows from the premises. Thus, a dog loses his master, and follows him by scent till the road branches into three; he smells at the first, at the second, and then, without smelling further, gallops along the third. That animals should be found to possess in perfection every faculty which is necessary for their well-being, is nothing wonderful; the wonder would be if they did not: but they sometimes display a reach of intellect beyond this. For instance, dogs have a sense of time, so as to count the days of the week: one has been known to trudge two miles every Saturday to market, to cater for himself in the shambles.

Among the mental problems which greatly occupied the attention of Ampère, the French *savant*, was the much-vexed question of the nature of the faculties of animals. He originally decided against their capacity to reason; but he abandoned his opinion in deference to a single anecdote related by a friend on whose accuracy he could rely. This gentleman, driven by a storm into a roadside inn, ordered a fowl to be roasted for his dinner. Turnspit-dogs were still employed in the south of France; the fowl was put down to the fire on the spit; but neither caresses, threats, nor blows could make the dog turn the wheel.* The gentleman interfered. "Poor dog, indeed!" said the landlord, sharply, "he deserves none of your pity, for this scene takes place every day. Do you know why this pretty fellow refuses to work the spit?—it is because he has taken it into his head that he and his partner are to share alike, and it is not his turn." Ampère's informant

* Arago's Account of Ampère.

begged that a servant might be sent to find the other Dog, who made no difficulty about performing the task. He was taken out after a while, and his refractory partner put in, who began, now that his sense of justice was satisfied, to work in his wheel with thorough good will, like a squirrel in a cage.*

A similar incident was related by M. de Liancourt to the great Arnauld, who had adopted the theory of Descartes, that Dogs were automatons and machines. "I have two Dogs," said M. de Liancourt, "who turn the spit on alternate days. One of them hid himself, and his partner was about to be put to turn in his place. He barked, and wagged his tail as a sign for the cook to follow him, went to the garret, pulled out the truant, and worried him. Are these your machines?" The great Arnauld, mighty in controversy and redoubtable in logic, must have had a latent consciousness that the turnspit had refuted him."

The origin of our domestic Cat has been much disputed. Dr. Ruppell maintains that all our varieties of the domestic Cat were derived from one species, which is yet wild in Nubia, and appears to have been the parent of the common Egyptian house-cat. Fischer maintains the domestic Cat of Europe to be of a different species. Temminck, after admitting the Egyptian species as the common ancestor of our house-cats, adds that probably the admixture of the Egyptian race with the wild one of our forests may have given rise to

* The contrivance was simply as follows: the wheel was inclosed in a circular box, and connected by a chain round the wheel end of the spit. The dog, on being put into the wheel, turned it as the squirrel does his wheel, and thus the spit was kept turning. In the kitchen of the ancient castle of St. Briavel, on the edge of the Forest of Dean, a few years since, might be seen this contrivance for the dog to turn the spit. For this purpose poor boys were previously hired; though they sometimes "licked the dripping-pan, and grew to be huge, lusty knaves."

an intermediate breed; "but which it would be impossible to prove by demonstrable evidence." "It appears to me," continues Temminck, "probable that our house-cats are derived from Egypt; but that the original race of Russia, known by the name of the Angora Cat, has been produced from another wild type, yet unknown, and inhabiting the northern regions of Asia." Now, this Angora Cat very closely resembles the Persian and Chartreuse, except in colour; and since the interbreed with the common Cat, we are able to explain much of the variety observable in the Cats of Europe and Asia.

Milne Edwards still insists on the identity of the wild Cat of Europe, and the domestic animal; and should this new view of the case ever be substantiated, we shall have to admit at least three wild species for the source of our domestic variety. But the difficulty does not end here: M. Blainville states that among the numerous Cat-mummies brought from Egypt by the French Commission, he has identified three indigenous African species, all reduced, in ancient times, to the domesticated state. Dr. Morton is the more gratified at this discovery, because he had already observed in the Chevalier Bunsen's Hieroglyphic Alphabet, *three different Cats*, each possessing a different symbolic value. These and other facts show that we may yet have to modify some of our Zoological impressions from a study of the Cat-mummies and representations on the monuments of Thebes. The Cat is to this day treated with consideration in Egypt, on account of its service in destroying reptiles; and we are told by Sir Gardner Wilkinson that benevolent individuals have bequeathed funds, by which a certain number of Cats are fed at Cairo, at the Cadi's court, at the bazaar of the Khan Kaleel. The learned Jacob Bryant, who professed to throw light upon the earliest state of Egypt, left among his MS. papers, an "Apotheosis of a Cat."

II.

CUVIER AND COMPARATIVE ANATOMY.

CUVIER, when a very young child, acquired a passion for reading, and a desire to understand everything. He was intended for the military profession: in the library of the Gymnasium, he lighted upon a copy of Gesner's *History of Animals and Serpents*, with coloured plates; and about the same time he discovered a complete copy of Buffon among the books of one of his relatives. His taste for Natural History now became a passion: at the age of 19, he went to reside at Fiquainville, in Normandy, near the seaport of Fécamp. The casual dissection of a colmar—a species of cuttlefish—induced him to study the anatomy of the molluscs; and the examination of some fossil Terebratulæ, which had been dug up at Fécamp, in June, 1791, suggested to him the idea of comparing fossil with living animals; and thus, as he himself said, "the germs of his two most important labours—the comparison of fossil with living species, and the reform of the classification of the animal kingdom—had their origin at this epoch." Soon after this, he met at Fécamp the Abbé Tessier, who wrote to Parmentier, that he had found a pearl in the dung-hill of Normandy; and recommending Cuvier to the celebrated Jussieu, Professor of Botany in the Jardin des Plantes, the Abbé tells him "to recollect that it was he who gave Delambre to the Academy; and that Cuvier would, in

another department, be a Delambre also." And the prediction was fully verified.

Of Cuvier's wonderful nicety of observation, there is a remarkable example relating to the sensitiveness of the wing of Bat. If one were to select an organ of the most exquisite delicacy, and sensibility, it would be the Bat's wing, which has, indeed, led some naturalists to assert the animal to possess a sixth sense. Cuvier has, however, traced the acuteness of sensation of touch in the wing, in these luminous words:— "The bones of the metacarpus, and the phalanges of the four fingers which succeed the thumb, are excessively elongated. The membrane which unites them presents an enormous surface to the air; the nerves which are distributed through it are numerous and minutely divided; they form a network very remarkable for its fineness and the number of its anastomoses. It is probable that in the action of flight, the air, when struck by this wing, or very sensible hand, impresses a sensation of heat, cold, mobility, and resistance on that organ, which indicates to the animal the existence or absence of obstacles which would interrupt its progress. In this manner, blind men discover by their hands, and even by the skin of their faces, the proximity of a wall, door of a house, or side of a street, even without the assistance of touch, and merely by the sensation which the difference in the resistance of the air occasions."

Sixty years have now elapsed since Cuvier completed the publication of his great work on Comparative Anatomy, known to comprehend the most perspicuous, correct, and complete systematic view of the science to be found in any language. Those who have seen the fossil deposits of a former age—the accumulated or scattered fragments of the

bones of various species—may form some estimate of the difficulty of the process by which a single bone was to be formed out of its parts, by which two bones were to be determined to be of the same species, and a complete skeleton of each separate species reconstructed out of pieces which belonged to no other animal. Before the genius of Cuvier, however, all these difficulties vanished. Fragment sprung into union with fragment—bone claimed kindred with bone—and, as if by the wand of an enchanter, new species of animals rose up like sudden creations—exhibiting to the astonished sage the forms and attributes of once living beings, which the eye of man had never seen, and which his wildest fancies could never have conceived.

Cuvier, describing his restoration of these exuviæ of a former age, accumulated in the cabinets of Paris, found himself as if placed in a charnel-house, surrounded by mutilated fragments of many hundred skeletons of more than twenty kinds of animals, piled confusedly around him. The task assigned to him was to restore them all to their original positions. At the voice of Comparative Anatomy, every bone and fragment of a bone resumed its place. "I cannot," says Cuvier, "find words to express the pleasure I experienced in seeing, as I discovered one character, how all the consequences I predicted were successively confirmed: the feet were found in accordance with the characters announced by the teeth; the teeth in harmony with those indicated beforehand by the feet. The bones of the legs and thighs, and every connecting portion of the extremities, were found set together precisely as I had arranged them before my conjectures were verified by the discovery of the parts entire. In short, each species was, as it were, reconstructed from a single one of its component

elements." In this manner did Cuvier re-establish 168 vertebrated animals, which form 50 distinct genera, of which 15 are entirely new; and reckoning the additions which have since been made, there is reason to believe that the species of extinct animals are more numerous than the living ones.*

The beautiful organization, as shown by means of this science, is thus illustrated by Cuvier himself, in his work, the *Theory of the Earth:* "Comparative anatomy possesses a principle, which, properly developed, was capable of clearing up all embarrassment: it was that of the natural relation of forms in organized beings, by means of which each sort of creature may, by rigorous scrutiny, be known by each fragment of each of its parts. Every organized being forms a whole, an unique and perfect system, the parts of which mutually correspond, and concur in the same definitive action by a reciprocal re-action. None of these parts can change without the whole changing; and consequently each of them, separately considered, points out and marks all the others. Thus, if the intestines of an animal are so organized as only to digest flesh, and that fresh, it follows that its jaws must be constructed to devour a prey, its claws to seize and tear it, its teeth to cut and divide it, the whole structure of its organs of motion such as to pursue and catch it, its perceptive organs to discern it at a distance; nature must even have placed in its brain the necessary instinct, to know how to conceal itself and lay snares for its victims. Such will be the general conditions of the carnivorous kingdom; every animal of this species will infallibly unite these qualities; for its race could not exist without them. But under these general conditions there are particular ones, relative to the size, species, and

* Abridged from the *North British Review*, No. 1.

haunts of the prey, for which each animal is inclined; and each of these particular conditions result from modifications of the detail in the formations which they derive from the general conditions; thus, not only the class, but the order, the genus, and even the species, are detected in the formation of each part."

This work is not a system of mere speculative theory, but a series of deductions from actual facts, authenticated by Cuvier's own researches into the fossil remains, classed according to the strata in which they were found. The author draws the following conclusions:

1. That in the strata called primitive there are no remains of life or organized existence.

2. That all organized existences were not created at the same time, but at different times, probably, very remote from each other: vegetables before animals, the molluscs and fishes before reptiles, and the latter before the mammalia. The transition limestone exhibits the remains of fishes, reptiles, and quadrupeds, the beings of a former order of things which have now disappeared.

3. That among fossil remains no vestige appears of man or his works, no bones of monkeys are found, no specimens of the whole tribe of quadrumanous animals.

4. That the fossil remains in the more recent strata are those which approach nearest to the present type of the corresponding living species.

5. That the stratified layers which form the crust of the globe are divisible into two classes, one formed by fresh water and the other formed in the waters of the sea; a fact which leads to the conclusion that several parts of the globe have been alternately covered by sea and by fresh water.

From these and other facts, Cuvier concludes that the actual order of things on the surface of our globe did not commence at a very remote time: he agrees with Dehuc and Dolomieu, that the surface of the earth was subject to a great and sudden revolution, not longer than five or six thousand years ago, and that this catastrophe caused the disappearance of countries formerly the abode of man, and of species of animals now unknown to us. But he also believes that the countries now inhabited had been at some former period, long before the creation of man, inhabited by land animals, which were destroyed by some previous convulsion; and that this globe has undergone two or three such visitations, which destroyed as many orders of animals, of which we find the remains in the various strata.

These conclusions of some forty years since are of peculiar interest in comparison with recent researches on "The Antiquity of Man." With what truth Cuvier foretold the advancement which would be made in this branch of study is best attested by the following passage at the close of his work on fossil remains, where he thus modestly expresses himself:—"I have no doubt, that in a few years, the work which I now terminate, and to which I have devoted so much labour, will be but a trifling sketch, a first glance thrown over the immense creations of antient times."

At the period of the death of Cuvier, in 1832, one of his biographers, after enumerating his scientific labours as having placed him in the very first rank of the great disciples of Bacon and nature, remarked: "Such was the man whose loss the world has now to deplore; but the mind that traced her age and history in the wrecks of ages, dug from her bosom,

will live for ever in his works to enlighten and instruct mankind." That this writer's estimate has not been impaired by time is shown in the following opinion of an eminent philosophical writer of the present day:—

"With the utmost refinement of observation in minute details, and analytical acuteness of the highest order, Cuvier united the power of large generalization, ever under the guidance of a calm and comprehensive judgment. He was a fine embodiment of inductive philosophy. He gave to the multifarious details of the science of Natural History a classification, the characteristic features of which will probably ever remain, under any modification which its details may undergo. He established the great principle of the mutual relations of the different organs, in subservience to the accomplishment of determinate purposes in the economy of each individual animal,—its habits, the obtaining of its food, its nourishment, and the continuance of its species. Hence he was enabled to reconstruct so beautifully the skeletons of different vertebrate animals from the fossil fragments of their bones and teeth, with which the quarries of Montmartre, more especially, so happily supplied him. He thus laid the foundation of that great branch of palæontology which relates to the Vertebrata, and which has since been so successfully prosecuted by his successors, and by none more so than our distinguished countryman, Mr. Owen."*

The body of Cuvier was examined by several eminent pathologists. The volume of his brain was extraordinary. It weighed three pounds, ten ounces, four drams and a half, being much above the extreme weight (three pounds, three ounces, and three quarters,) mentioned by Soemmering.

* W. Hopkins, M.A., F.R.S.

Besides, the cerebellum and tuber annulare were compared with those of a male adult, and found to exceed them in weight by a dram and a half; so that, in M. Cuvier, the excess was almost wholly confined to the extraordinary development of the anterior lobes—that is, to the organ of the intellectual faculties. Again, according to M. Desmoulins, one of the characters of the brain with which superiority of intellect seems to be associated, is great extent of surface—resulting from the number and depth of the convolutions—so that a great expansion of this kind might be comprehended within a cranium of moderate dimensions. Viewed in this light, the brain of M. Cuvier was even more remarkable than with respect to its size.

Cuvier's memory was prodigious, and he scarcely knew what it was to forget anything. Although his great powers were more particularly devoted to Natural History, no part of science was a stranger to him; and his taste for literature and works of imagination was particularly refined and elegant. In his *Eloges* of illustrious men, he always evinced the utmost impartiality and love of truth: he never debased the dignity of science by any love of intrigue, but displayed the purest disinterestedness in his efforts to promote science. The qualities of his heart were not less estimable than those of his head, and he possessed the happy gift of inspiring his friends with unchangeable attachment. His conversation was varied and animated, adapted by turns to every subject, and he may truly be said to have been the grace and ornament of society.

III.

HOW LONG DO ANIMALS LIVE?

THE Age of Animals is a question of considerable importance and interest; but its determination has been attended with uncertain results. As far as regards animals, indeed, it has been said that the duration of life is generally between seven and eight times the period which elapses from birth till they become adult; but this rule is vague and indefinite, and useless and inapplicable in practice. More certain results are derived from observing the growth and decay of teeth; and if we were acquainted with the various phenomena which attend the development of these organs in all quadrupeds, there is no doubt but that we should be enabled to obtain general, and in a great measure certain rules. At present, however, we do not possess observations sufficiently extensive for the above purpose; and only in the cases of the most important domestic animals has it been determined.

Little has been written on the longevity of animals, with the exception of man. Instances of great length of days in man are by no means rarely recorded, but even these are rarely to be trusted; so that we need not be surprised at the uncertainty which exists as to the ages of the lower animals. Those whose longevity has been noticed, have been kept domesticated, or otherwise constantly under the observation of man; "but as animals in such states are usually either kept

in climates not so well fitted for them as those of which they are properly natives, closely restricted of liberty, more exposed to diseases and injuries, fed on artificial food, forced to perform laborious tasks, beaten or otherwise fretted; and as many of them are subject to all these grievances, it is probable that they do not attain to those periods which they would if permitted to live in a state of nature, and they were fortunate enough to escape accidents, diseases, and predaceous enemies." (*J. H. Fennell.*) Nevertheless, the observation of naturalists, and persons interested in the age of animals, has been productive of many trustworthy data of *great ages*, and the concomitant habits; and from such reliable materials our records will be derived.

The family of Lemurs from Madagascar are believed to be long-lived: a Ruffed Lemur, which was kept in the Museum of Natural History at Paris, had been in Europe nineteen years.

The Bat is presumed to live to a great age, from its having been repeatedly found alive, enclosed in the centres of trees, which the animal had entered some time previously, when about to become torpid; hence, at the period of the discovery, it was inferred to be of considerable age, as it must have taken a long time for the wood to surround the animal.

The Brown Bear is stated by Falk to grow to about his twentieth, and to live until his fiftieth year. "In the pits of Berne, where it has been the fashion, for many centuries, to keep some of these animals for name's sake, at the public expense, a pair were living in 1771 which had been confined there for thirty-one years. Another individual, which was born in the same pits, was living at the commencement of the present century in the Menagerie of the Jardin des Plantes, at Paris, at the age of forty-seven. (*Zoological Gardens*

Illustrated.) A grisly Bear is known to have lived in the Tower Menagerie upwards of twenty years.

The Dog is complete in its growth at two years; at the expiration of five years it is considered old, and the limits of its existence rarely exceed twenty years: greyhounds attain that age oftener than other varieties.

The Wolf generally lives twenty years.

The Fox attains its full size in a year and a half, and has been known to live thirteen or fourteen years; but, as this can only have been ascertained, observes Mr. Bell, of individuals in confinement, it is very probable that in a state of nature, it considerably exceeds that period.

"Lions," says Bacon, "are accounted long livers, because many of them have been found toothless." The great lion, Pompey, which died in 1760, was known to have been in the Tower Menagerie above seventy years; and one brought from the river Gambia, died there at the age of sixty-three.

The Domestic Cat rarely reaches fifteen years: it is strange that the Cat, with its proverbial *nine lives* should not be put down at a greater age.

A Correspondent of *Notes and Queries* records a white Cat, with blue eyes, having attained the age of seventeen years. Cats attain a large size. In 1850 we saw at No. 175, Oxford-street, a beautifully-marked tabby male Cat, weighing twenty-three and three-quarter pounds, and measuring twenty-seven inches round the body, and thirty-six inches from the tip of the tail to the end of the nose; height to top of shoulders, eleven and a half inches; he was then seven and a half years old.

The Virginian Opossum is reputed to live so long, that a saying has become common among the people of North

Carolina, that if a Cat has nine lives, the Opossum has nineteen.

A Squirrel has been known to live in confinement seven years.

The Hare, according to Goldsmith, seldom exceeds seven or eight years. The Rabbit, says Bacon, is said to live scarcely seven years. The Hare was not eaten in Britain, in the time of Cæsar.

The Elephant was believed by the ancients, according to Philostratus, to live more than four hundred years. He founded this belief upon a story of an elephant with a particular mark having been captured by Juba, King of Lybia, four hundred years after a battle in which the animal had fled to Mount Atlas. This is not grounded upon a sufficiently accurate chronology to command our credence. Tavernier appears to have had tolerable evidence, from the accounts of the keepers of the elephants in India, that particular individuals had been in captivity from one hundred to one hundred and thirty years. * * * Pliny, upon the authority of Aristotle, states that the Elephant lives two or three hundred years; and the Romans, in the time of Gordian, in the spirit of poetical exaggeration, chose an elephant for the symbol of eternity. (*The Menageries.*) Dr. Franzius, in his *History of Brutes*, relates that, "when Alexander the Great had conquered one Porus, King of India, he took a great elephant, which had fought very valiantly for the King, named him Ajax, and dedicated him to the sun, and let him go with this inscription,' 'Alexander, the son of Jupiter, hath dedicated Ajax to the sun.' This Elephant was found with the same inscription three hundred and fifty years after; but many of them do not live to that age, for they are often sick

of very dangerous diseases." Blumenbach says: "It is probable that the Elephant will live two hundred years." *

Pigs have been known to reach the ages of twenty-five and thirty years.

The Rhinoceros is only full-grown at twenty years of age; so that Goldsmith's conjecture that "it lives seldom more than twenty years" is of little worth. A specimen died at Versailles in 1793, at the age of twenty-six years. The Indian one-horned Rhinoceros brought to England by Mr. Cross, in 1834, was little more than a year and a half old.

The Horse's life seldom exceeds thirty years, though there have been instances recorded in which it is said to have extended to double that period. "Of the natural age of the Horse we should form a very erroneous estimate from the early period at which he is now worn out and destroyed.

* Persons who take their notion of the consumption of ivory from a toothpick will be surprised at the immense demand there is for that material in the present day. We gather from *Galignani's Messenger* that in England are consumed a million pounds of ivory per annum, or upwards of three times the consumption of the year 1827; and the number of elephants killed for England alone are reckoned at 8333, "or thereabouts." Some 4000 men, it is added, lose their lives annually in the pursuit after ivory—that is, to provide the world with combs, toothpicks, knife-handles, billiard-balls, pianoforte-keys, &c. A tusk weighing 70 lbs. is considered by the trade a first-class one. The largest registered by Cuvier weighed 350 lbs. Elephant-hunters, however, now penetrate further into Africa, and meet with older animals. A short time ago an American house cut up an elephant's tusk 9ft. in length, and weighing 800 lbs. In 1851, the same house sent to our Great Exhibition the largest piece of sawn ivory ever known; it was 11ft. in length, and 1ft. broad. The dearest ivory is that which is used for billiard-balls; that which is brought from the west coast of Africa, except Gaboon, is much less elastic than other sorts, and is only used for knife-handles. The French in Algeria have considerably extended the ivory trade in the north of Africa, which receives its supply from the caravans crossing the Desert.

Mr. Blaine tells us of a gentleman who had three horses which died at the ages of thirty-five, thirty-seven, and thirty-nine. Mr. Cully mentions one that received a ball in his neck at the battle of Preston, in 1715, and which was extracted at his death in 1758, and in his sixty-second year." (*The Horse: Library of Useful Knowledge.*) In the Manchester Natural History Society's Museum are preserved the stuffed skin of the head and the skull of a horse who worked all his life on the towing-path of the Manchester canals, and died in 1822, in his sixty-second year. "On the death of Lady Penrhyn, in 1816, six of her horses had pensions assigned to them; each 45*l.* a-year. Five of them died at the respective ages of twenty-eight, twenty-nine, and thirty-one years. The last died at the age of thirty-four years; the executors having paid on the pension of this horse 810*l.*"

"The Ass," says Bacon, "lives commonly to the age of the horse; but the mule outlives them both."

The Camel, according to Marplett's *Green Forest*, 1567, sometimes reaches the age of one hundred. A camel kept in the Jardin des Plantes, is supposed to have been fifty years old at the time of his death. The Llama, nearly allied to the Camel, lives more than fifteen years.

The Elk, which does not reach his full growth till his fourteenth year, probably, attains a great age, as the Indians believe they are to enjoy a long life if they frequently dream of this animal.

The Stag is believed by modern naturalists not to attain fifty years: a writer in *Fraser's Magazine*, in 1857, says: "Judging from our own experience, from twenty to thirty years, or about that number, form the average duration of a Stag's natural life. After ten years have passed over the

hart, he is no longer in his prime. He then begins to go back, the 'backwardation' being first observable in the beam of the horns, which becomes smaller and less round. The deer shed their horns annually; they have them at first in the form of simple prickets, without any branches or antlers; but each succeeding year adds one or more branches, according to the species, up to a certain time, beyond which the age of the animal can only be guessed at from the size of the horns, and the thickness of the burr or knob at their roots, which connects them with the skull. The traditional opinion that the Deer sometimes attains the age of upwards of a hundred years, is not worthy of countenance. The superstitions of the Highlands of Scotland, and the Gaelic adage, 'Thrice the age of a man is that of a deer,' may be supported by marvellous stories, attested by chiefs of honour and veracity; but, with all his respect for traditions, Mr. Scrope, in his work on Deer-stalking, does not hesitate to inform us that all the accounts he has received from the park-keepers in England, where there are red-deer, contradict their supposed longevity, and establish the fact that the longest-lived deer has not exceeded twenty years of age. (*Edinburgh Review*, No. 143.) From this time his head and himself dwindle, peak, and pine." The Waipiti Deer is, however, believed to be so long-lived, that the Indians say of an aged man, "he is as old as a Waipiti."

Cows live about fifteen years; but the Ox, according to Mr. W. H. White, lives about thirty years. The Aurochs, Zubr, or European bison, a species of primæval ox, lives about forty years, is of great weight, and a slow mover, but in defence can master three wolves. This appears to be the only one of its class of quadrupeds that is living in our own

day, which once roamed over all the woodland districts of Central Europe, and which, in our own island, was contemporary with the extinct races of mastodon, elephant, and rhinoceros. The Aurochs exists only in one locality, in the forest of Bialavieja, in Lithuania, where it is carefully protected by the Russian government from extirpation. As a royal hunting-ground it has been preserved in the primitive state of an American forest, inhabited by bears, wild boars, wolves, foxes, lynxes, elks, and roebucks, together with the aurochs. A young male and female Aurochs, captured in 1846, were presented to the Zoological Society, by Nicholas, Emperor of Russia, who likewise presented a pair of stuffed specimens to the British Museum.

Of the ages of animals in confinement, Mr. Edward Cross, proprietor of the Menagerie at Exeter Change, and subsequently at the King's Mews, and the Surrey Zoological Gardens, Walworth, gave the writer the following as the result of forty-eight years' experience in keeping animals. Lions, Tigers, Leopards, Jaguars, and Hyenas, upon an average, live twenty-five years; the smaller cats, as the Tiger-cat, Lynx, Ocelot, Margay, and Serval, sixteen to eighteen years; Monkeys and Baboons, sixteen to eighteen years; the Coatimondi, Racoon, Beaver, and Civet-cat, twelve to fourteen years; the Antelope, sixteen to eighteen years.

The little that is recorded of the longevity of *Cetacea* favours the supposition of their being long-lived. The age of the Whale is known by the size and number of laminæ of whalebone, which increase yearly, and if observation can be relied upon, would sometimes indicate an age of three or four hundred years for these animals.

The Rorqual, of this family, about 100 feet in length, is

the largest animal; the Monad is the smallest; and the creature just half way between them is the common Fly.

The Greenland Whale, whose skeleton was exhibited on the site now Trafalgar-square, Charing Cross, in 1831, was concluded by Cuvier, and other French naturalists, from certain data, to have been from nine hundred to a thousand years old! Still, the ages of the Dolphin and Porpoise, which are of the same order, are stated but at thirty years.

The Age of Birds may sometimes be determined by observing the form and wear of the bill. Smellie, in his *Philosophy of Natural History*, says: "Most birds acquire their full dimensions in a few months. In proportion to the size of their bodies, birds are much more vivacious, and live longer than either men or quadrupeds." Bechstein, in his work on Cage Birds, tells us that their age is so much the more interesting, as it is only by observing it that we can know with any degree of certainty the length of Birds' lives in general.* * * Birds live fifteen, twenty, and even thirty times longer than the time which they take to grow. This length of life is sometimes attributed to the substance of which their bones are composed being much more loose and light, and, consequently, remaining porous longer than those of quadrupeds."

The age of the Eagle is almost proverbially great. From Herodotus and other ancient writers it appears probable that the notion of a Phœnix was derived from some species of Eagle: hence it is described as excelling all birds in longevity. Manilius states its life at six hundred and sixty years; Tacitus, at five hundred years, though he admits that some writers extend it to fourteen hundred and sixty-one!—which statements are not a whit more to be trusted than the account

of the Artificial Eagle, which Müller, or Regiomontanus, is said to have constructed, and which flew a considerable distance to meet the Emperor Maximilian; or the Wooden Pigeon of Archytas, which was capable of flying!

Pennant, writing in 1768, describes an Eagle, then possessed by Mr. Owen Holland, of Conway, which bird was upwards of thirty-two years old. Bacon states the life of a mewed Hawk at thirty years, and a wild Hawk at forty. In the *Gentleman's Magazine*, 1793, is quoted a story of a ship having in 1792, brought from the Cape of Good Hope, a Hawk captured there with a golden collar inscribed as belonging to James I., 1610; which, if to be trusted, would make this bird at least 182 years old! Vultures, according to Bacon, extend their lives "well neare to a hundred years."

Bechstein gives the following periods of the lives of Birds in confinement:—Bohemian Chatterer ten or twelve years; Rose-ouzel, eight years; Ring Blackbird, six to ten years; common Blackbird, with care and proper variety of food, ten or twelve years; Missel-thrush, ten to twelve years; Song-thrush, five or six years; common, grey, and yellow Wagtails, in a room, five or six years; common Redstart, rarely above three or four years, though Mr. Sweet kept one, old when first caught, more than six years; black Redstarts, five or six years in a cage; the Wheatear, with great attention, can rarely be preserved alive more than two years; the Blackcap will live almost fifteen years; the Siskin, eight to twelve years; the Redbreast, in a room, ten to twelve years; the Wren, two or three years; the Titlark, five or six years; a Skylark has been known to live thirty years; Woodlark, eight years; foolish Bunting, six years; black Bonnet, five or six years; Ortolans, three or four years; Snow Bunting, in a

room, six years; painted Bunting, eight to ten years; Chaffinches have been known to live more than twenty-four years in a cage; Goldfinches, sixteen and even twenty-four years; Amandava, from six to ten years; Whidah-finch, eight to twelve years; Green-bird, twelve years; and Starlings ten or twelve years.

The Canary-bird is long-lived: there is a well-authenticated record of a Canary which had been hatched in a cage, and was never out of the possession of its mistress, and at the time of his death was just twenty-six years of age.

"A Nightingale," says Bechstein, "may be kept in confinement fifteen years; whilst, in a wild state, they are never observed to exist so long in the same spot, which seems to prove that they do not attain so great an age when exposed to all sorts of accidents, both from birds of prey and bird-catchers. I have an instance of a Nightingale which has lived twenty-five years in confinement." Dr. Weissenborn relates that a tradesman in the town of Weimar, in Germany, had a Nightingale which hung for sixteen years in his parlour; and its former owner had the bird six years. It sung beautifully throughout the year, except in April and May, when it moulted. After the tradesman had possessed the bird sixteen years, a tax of six dollars a-year was levied upon every Nightingale in captivity; when the owner at Weimar thinking it unjust that he should be taxed for a bird caught so long ago, gave the bird to a physician, who kept it for five years; it had two other owners, who kept it six years, when the bird died; so that this Nightingale, which had been caught in its adult state, cannot have lived much less than thirty years in its prison.

The Raven, according to Hesiod, lives one hundred and eight times as long as man, which implies, taking seventy

years to be the common extent of human life, that it lives seven thousand five hundred and sixty years! In the *Athenian Sport*, the Raven's life is given at six hundred years! The more reasonable life is one hundred years, of which Buffon records instances in several parts of France. Rennie sets the age at 108 years. The Crow, according to Montbeillard, lives a century or more. Shakespeare calls this bird "the treble-dated crow." In the *Magazine of Natural History* is mentioned a carrion-crow upwards of sixteen years.

Parrots live to a great age. In 1838, it was stated in the *Magazine of Natural History* (from the *Nuremberg correspondent*,) that a person possessed for thirty-two years a grey parrot, which he received from a relative, who had kept it forty-one years, making its age in 1837, seventy-three years, exclusive of its age when brought to Europe. This aged bird had lost its sight and memory, and was constantly dozing. In its youth it was very talkative; at sixty, its memory began to fail, it could not be taught anything new, and it jumbled together the phrases it knew. Till sixty, it moulted once a-year, and the last time, the red feathers in its tail were exchanged for yellow ones. Mr. W. H. White, in the above *Magazine*, records, in 1836, a Parrot, eighty-five years old, and another, upwards of one hundred. Professor Schulze, of Göttingen, relates that a Parrot, which in 1633, was brought from Italy into France, was living in 1743, consequently more than one hundred and ten years old.

The Peacock, according to Bacon, lives twenty years; "and he cometh not forth with his Argus eyes before he be three years old."

The common Fowl's age extends to ten years: Captain

Brown relates instances of hens living to thirteen and even fifteen years. Pheasants and Partridges may live to sixteen.

Ring-doves are stated to live fifty years. Stock-doves not above five or six, though Smellie mentions pigeons at twenty and twenty-two years; Turtle-doves, seven years.

A Heron has been known to live sixty years; and a Numidian Crane, hatched in the Menagerie at Versailles, lived twenty-four years.

The Sea-gull lives long: one lived fourteen years at the George Inn, Castleton, Isle of Man.

The Swan is set down by Bacon at one hundred years, by Goldsmith at three hundred! In Alkmar, a town in the north of Holland, there died, in 1672, a Swan, bearing a collar dated 1573; and several instances of a similar nature have been related by authors. (*Zoological Gardens Illustrated.*) In 1833 there died "the old Swan of Dun," at the age of two hundred years: the bird is preserved in Molleson's Museum.

The Pelican is proverbially long-lived. Aldrovandus mentions one that lived at Mechlin, and was supposed to be fifty years old. Faber speaks of one kept by the Duke of Bavaria above forty years. Sir Thomas Browne describes a Pelican exhibited in King-street, Westminster, in 1647.

The Goose is a long liver. John Aubrey notes that—"Farmer Ady, of Segary (Wilts), had a Gander that was fifty years old: he and his Gander were both of the same age. (A Goose is now living, anno 1757, at Hagley-hall, in Worcestershire, full fifty yeares old.)" "A certain friend of ours," relates Willoughby, "of undoubted fidelity, told us that his father had seen a Goose that was known to be eighty years old," when he was killed for his ill-treatment of younger geese.

Of the Duck's great age we have no reliable record: there

is an apocryphal story of a large Mallard found in a drain, in building All Souls' College, Oxford; which bird is stated to have been of great age.

The Ostrich is stated, from the evidence of travellers and naturalists, to live between twenty and thirty years.

Reptiles, when they escape the attacks of man and other enemies, are believed to live often to a very great age.

The Tortoise is of proverbial longevity. Among the curiosities at Lambeth Palace is the shell of the Tortoise believed to have lived in the palace-garden from the time of Archbishop Laud, 1633, to 1753, when it perished through the gardener's neglect. A Tortoise in the Bishop's garden, at Peterborough, lived two hundred and twenty years. Captain Good, of the Trinity House, had a live Tortoise which had belonged to Lord Clive, and which, from corroborating circumstances, was not less than two hundred years old: it died about 1821.

The Toad is long lived, without reference to the many stories of its being found in blocks of stone, or wood, when it has been concluded that its age must have been very considerable, as a great space of time must necessarily have elapsed to gradually effect this inclosure. Mr. Arscott mentions a Toad that lived thirty years, at which age it was killed by a raven. (*British Zoology.*) Jesse mentions another Toad, which was confined in a flower-pot twenty years, at the expiration of which time it was found alive and healthy.

The question of Toads or Frogs living in blocks of stone or wood, has been decided by the experiments of Dr. Buckland, which are detailed in the *Curiosities of Natural History*, by Mr. Francis Buckland, M.A., the Dean's son. The results were unequivocal. Whenever the animals were inclosed in substances which admitted of *no* communication with the

air, they died in a few months; whenever there was a communication, however slight, with the air, they lived, and what is more, *increased in weight*, showing that insects must have been admitted through the porous material. If, therefore, we suppose a young toad to have sought shelter in the crevice of a rock, or tree, by some very narrow aperture, it would find abundance of nutriment in the insects which came there, and in the course of time would grow to a size which would prevent its egress. The hole may have been further blocked up by clay or gravel, yet, still admitting the air, and the toad would continue to flourish. Such a hole would easily escape the observation of workmen, generally the persons who are said to find the animals in such cavities; and thus the stories may be true, to a great extent, without there being the slightest foundation for the inference that toads are enabled to live in blocks of stone excluded from the atmosphere.

The Crocodile, Blumenbach infers to live more than one hundred years.

The Proteus, such as Sir Humphry Davy found in the lake in the Grotto of the Maddalena, at Adelsburg, several hundred feet below the surface of the earth, has been kept alive for many years by occasionally changing the water in which it was placed.

Lizards are long-lived: a very large Water Eft was found by Captain Brown, in a wooden conduit at Edinburgh, which had been stopped up at both ends, for upwards of twenty years; so that the animal must have been at least that age, as it was not possible that it could obtain access from the time the conduit was stopped up.

Serpents, from their vast size, and the importance attached

to them in ancient times, are reputed to live to a great age. Their powers of abstinence would also favour this notion. Dr. Shaw relates that a couple of Egyptian Cerastes were kept five years in a closely-corked bottle, without any sort of food, unless a small quantity of sand in which they coiled themselves up at the bottom of the vessel may be called such; yet, when Dr. Shaw saw these serpents, they had newly cast their skins, and were brisk and lively. Mr. Bates, when on the banks of the Amazons River, encountered large serpents, of the boa species, one of which, the Anaconda, grows to an enormous bulk, and lives to a great age: Mr. Bates heard of specimens having been killed which measured 42 feet in length, though he did not encounter any of this size himself.

"The Age of Fishes," says Bacon, "is more uncertain than that of terrestrial creatures; because, living under water, they are the less observed." Some pretend to distinguish the ages of Fish by the appearance of the scales, which, by aid of the microscope, are seen to consist of circles within one another, resembling the rings in sections of trees, by which their ages are computed. The first methods are, however, founded upon mere hypothesis, and are not entitled to confidence. Nevertheless, the longevity of Fish is asserted with great confidence, and is ascribed by Smellie, to the element in which they live being more uniform, and less subject to accidental changes than the state of our atmosphere. Their bones are more cartilaginous than those of land animals, and admit of indefinite extension; and their bodies, instead of suffering the rigidity of age at an early period, which is the natural cause of death, continue to grow much longer than those of most land animals. To this philosophizing Smellie

adds, "Some Fish live during several centuries." It is curious to note here that living under water, to which Bacon attributes the little we know of the ages of fish, is, by Smellie, considered one of the causes of their long life.

Nevertheless, stories of strange fishes, and fishes of preternatural age, size, and ugliness, are very plentiful. First is the monstrous myth, the great Manheim Pike, with a collar about his neck, put into a lake by the Emperor Frederick II. in the year 1230, and taken out in the two hundred and sixty-seventh year of his age, the seventeenth foot of its length, and the three hundred and fiftieth pound of his weight, as recorded by Gesner. M. Valenciennes has found this monster to be apocryphal; at any rate the creature has been taken in several places at once; the legends written on his collar do not agree; and his alleged skeleton has been found to be made out of the bones of various fishes, while the number of vertebræ are far too numerous. Bacon considers the Pike as our oldest fresh-water fish. Buffon describes two Pike—at one hundred and one hundred and fifty years old—but this was determined by the uncertain mode of the circles of their scales. A Pike, between four and five feet long, and believed to be a century old, was taken in 1865, at St. Paul en Cornillon, on the Loire. In its stomach were found a double-bladed knife, a small key, and the steel snap of a purse; the fish was to be prepared for the museum of Saint Etienne.

Carp are long-lived: Gesner says that one in the Palatine lived to be one hundred years old. In the basin of Emanuel College, Cambridge, in 1782, was living a carp in its thirty-sixth year. The carp of Charlottenburg, near Berlin, are of great age.

A Cod-fish is stated to have lived seventeen years in Colonel MacDowal's celebrated salt-water pond at Logan, in Scotland: it died totally blind, and shrunk in bulk, in 1826.

The Salmon, the Bream, and the Eel, are each set down, by Bacon, at ten years. And, upon the same authority, Lampreys are stated to have been found in Cæsar's fish-ponds which had lived threescore years.

Insect life presents comparatively few authenticated instances of longevity; whilst many insects enjoy a proverbially short existence.

Day-flies are named *Ephemeræ* from their being said to live only one day, and in some specimens, only a few hours; but they occasionally live, in their perfect state, two or three days, and in the larva state for two years. Cuvier, however, says: "The day is to these flies their whole period of air-breathing life. The period is short; but that is necessary: for in some places, if they were to live long, there would absolutely be not room for them. They eat nothing, and so destroy nothing; but there are places in France and Germany where, if they lived but for a month on the wing, they would build up the air solid to the tops of the trees. As it is, they sometimes fall on the ground near the rivers in showers like snow, and the people collect them in heaps as manure to the fields."

Bees do not attain great age. Dr. Bevan estimates the average length of a drone's life to be about four months; a worker bee's about six months; and a female bee's (called a queen) about four years.

Beetles are of proverbial longevity. A group of them, the *Scarabœides*, was worn as armlets, not only in Egypt, but in many parts of the ancient world. "The Scarabæus," says Mr. Hamilton Gray, "was to the ancients what the

crucifix is to Roman Catholics." Among the long-lived beetles is the Stag Beetle, which lives three years in its larva state, and a few weeks in its perfect state. In Kirby and Spence's *Entomology* is recorded that the grub of a handsome Beetle, (*Buprestis splendida,*) was ascertained to have existed in the wood of a deal table more than twenty years. The Churchyard Beetle lives long: Baker, the microscopist, kept a specimen alive for three years without a morsel of food. In 1846, Sir John Richardson exhibited to the British Association a specimen of the above Beetle, which had been found embedded in some artificial concrete, where it must have been, at least, *sixteen years;* yet, when the animal was brought to Sir John Richardson, it was alive, and lived six weeks after. Mr. Darwin states this Beetle to be very tenacious of life: he once left a specimen in a covered vessel, without food for a whole year, without its being killed; he also dropped upon one hydrocyanic acid, but it walked off quite unaffected by the poison.

Many Molluscs, more especially the terrestrial, have their existence suspended for an indefinite period, and again renewed by the application of heat and moisture. "All the land Testacea," says Dr. Fleming, "appear to have the power of becoming torpid at pleasure, and independent of any alterations of temperature. Thus, even in Midsummer, if we place in a box specimens of the Garden Snail, without food, in a day or two they form for themselves a thin operculum, (or lid,) attach themselves to the side of the box, and remain in this dormant state. They may be kept in this condition for several years. No ordinary change of temperature produces any effect upon them, but they speedily revive if plunged in water." Sir Charles Lyell tells us that "four individuals of a large species (of Snail,) *Bulimus,* from

Valparaiso, were brought to England by Lieutenant Graves. They had been packed up in a box, and enveloped in cotton, two for a space of thirteen, one for seventeen, and a fourth for upwards of twenty, months; but, on being exposed by Mr. Broderip, to the warmth of a fire in London, and provided with tepid water and leaves, they revived!" Dr. Elliotson put a Garden Snail into a dry closet, without food for a year and a half; it became torpid, and remained so, except when revived with a few drops of water. But these instances are as nothing when compared with the torpid Snails of Mr. Stuckey Simon, a Dublin merchant, which, on being immersed in water, recovered and crept about after an uninterrupted torpidity of *at least fifteen years;* and this Mr. Bingley, in his *Animal Biography*, considers a well-authenticated fact.

Professor Eaton, of New York, however, relates a still more marvellous instance: he states that the diluvial deposits through which the Erie Canal was made, contained ridges of hard compact gravel; on cutting through one of which, the workmen found several hundred of *live* molluscous animals; he adds: "I was assured that they were taken *alive* 42 *feet deep in the deposit*, which is diluvial. These animals must have been there from the time of the Deluge, for the earth in which they were is too compact for them to have been produced by a succession of generations. These fresh-water clams of 3000 years old precisely resemble the same species which now inhabit the fresh waters of that district: therefore, the lives of these animals have been greatly prolonged by their exclusion from air and light for more than 3000 years. (Silliman's *American Journal*).

The Sea Anemone, very low in the scale of existence, has been known to exceed our manhood, as we shall presently show. (See page 71.)

IV.

LIFE IN THE SEA.

YOU are going down, perhaps by railway, to pass your usual six weeks at some watering-place along the coast, and as you roll along think more than once, and that not over-cheerfully, of what you shall do when you get there." Such is the opening of the Rev. Charles Kingsley's wonderfully pleasant little book, *Glaucus; or the Wonders of the Shore*, in which the author provides many a welcome resource for "the ignoble army of idlers" who saunter about the cliffs, and sands, and quays.

Besides Mr. Kingsley's *Glaucus*, many other books have been provided of late years for those persons who feel inclined to devote their leisure to so charming a study as that of Natural History, in the fields and woods, and by the roadside; upon the banks of the shining river; and by the shore of "the wide blue sea," of which how truly has it been written, that "the Spirit of God moves upon the face of the waters."

We are old enough to remember when such books were few and difficult of access; when Sir Joseph Banks and Bewick were the great authorities, and Goldsmith turned Buffon into English, in his *Animated Nature*. Gilbert White's *Natural History of Selborne* was almost the only book of the familiar class for a field naturalist; the Linnæan Society's Museum was rarely accessible save to Fellows; the British Museum

collections were ill arranged among the faded finery of Montague House; and there was no Zoological Society's Garden, notwithstanding tourists had long enjoyed the *Jardin des Plantes*, at Paris. True it is that Natural History in the Museums of the last century was little better than a bundle of absurd wonders, recalling the apothecary's collection:

> In his needy shop a tortoise hung,
> An alligator stuff'd, and other skins
> Of ill-shaped fishes.

We must remark, by the way, that the extension which is now given to the name of Museum in the language of naturalists, and even by the public at large, is an indication of more correct views than were formerly entertained with regard to the uses of such establishments. Few, for instance, have such a notion of a Museum as Horace Walpole, when, in the last century he defined it as "a hospital for everything that is singular, whether the thing has acquired singularity from having escaped the rage of time, from any natural oddness, or from being so insignificant that nobody thought it worth while to produce any more of the same." "The stuffed ducks, the skeleton in the mahogany case, the starved cat and rat which were found behind the wainscot, the broken potsherd from an old barrow, the tattooed head of the New Zealand chief, the very unpleasant-looking lizards and snakes, coiled up in the spirits of wine, the flint-stones and cockle-shells, &c." will no longer be seen jumbled together in heterogeneous confusion, since the system of a Museum of the present day is to collect a series of types illustrative of the mineral, vegetable, and animal kingdom, and thus the beautiful order of creation.

The good vicar of Selborne took the trouble to write a book

about the birds and weeds in his own parish, and the every-day things which went on under his eyes, and every one else's; and when persons could be got to read the book, honest was the young Squire's admiration. "Bless me, who would have thought there were so many wonderful things to be seen in one's own park!" and more morally valuable was the old Squire's exclamation, "Bless me! why I have seen that and that a hundred times, and never thought till now how wonderful they were!" Now, this kind of wonder must have been shared by many a reader who, in walking along the sea-shore, has seen the wild waves throw up small star-fish, "sea-grasses," cuttle-fish "bones," and hundreds of other objects, so as to favour the popular notion that the sea contains just the same animal and vegetable productions as those kingdoms possess on land.

Another early impression of the beautiful wonders of the ocean we received from the "sea-flowers," offered for sale at watering-places, in white basins of sea-water. Who does not recollect many a ramble on the sea-shore, collecting sea-weed, and then preserving its elaborate varieties in books, where, by a sort of "nature-printing," its form and colour were left upon the pages of the shut-up volume. We remember, too, a certain fucus, the pulp of which was a beneficial external application in spinal complaints: the sea side people had long known its efficacy, but it was reserved for our times to discover that such efficiency is owing to the quantity of iodine contained in the sea-weed. In reply to the question, "Where do we find iodine?" it has been eloquently answered: "All the fishes, shells, sponges, and ocean-weeds yield iodine; and the wrack-grass, whose fuci, which the boiling and rolling of the waves deposit upon the barren shores, seemed to be as

useless refuse, but are now known to yield a useful substance in pharmacy and the arts."

In those days of special wonder, books for the sea-side were few: and if, perchance, the visitors to watering-places were inclined to purchase any of the marine "curiosities" which were offered for sale upon the beach, or spread upon rickety tables at cottage-doors, little was felt beyond the moment as to the nature, object, or purpose of the specimen; but we agree with Mr. Kingsley, that "there are along every sea-shore more things to be seen, and those to be seen easily, than in any other field of observation which you will find in these islands. And on the shore only will you have the enjoyment of finding new species, of adding your mite to the treasures of science. There is no reason why you should not be as successful as a friend of mine, who, with a very slight smattering of science, and very desultory research, obtained, last winter, from the Torbay shores, three entirely new species, besides several rare animals which had occupied all naturalists since the lynx-eye of Colonel Montague discerned them fifty years ago." The art—how to observe—is, in our day, taught by *shore lectures*, in which Mr. Gosse, and other naturalists, take their pupils along the shore, and there illustrate the specimens which the waves have just thrown up; just as botanists go herborizing, or rambling about for field flowers; or the Members of the British Association make their geological excursions; and a learned Professor lectures *in a cathedral*, upon its architectural glories. There is nothing like having information *to hand*, so that you may get it the moment you want it: many an opportunity of acquiring it is lost for the trouble of stepping from one apartment to another to fetch the book which contains it.

Organic life, in its animal form, is much more developed, and more variously, in the sea, than in its vegetable form. Of the more interesting marine animals we propose to give a brief sketch, to show what order reigns in the distribution of these curious creatures; what beauty may be traced in their variety and colour; and how wonderful is the agency of these minute but mighty forms.

First, we must say a few words of the vast extent of the region in which these creatures have their being. *How deep is the Sea?* is naturally one of the first questions likely to be asked of a person who professes to be largely acquainted with its mysteries. Now, astronomers have measured the distances and weighed the masses of the planets, yet the height of the atmosphere and the depths of the ocean are unsolved problems. The bottom of "blue water" is almost as unknown to us as the interior of the earth. It is a common opinion that the greatest depths of the sea are about equal to the greatest heights of the mountains. Attempts have been repeatedly made to sound its depths, but no reliance can be placed on any reports of sounding, beyond 8000 or 10,000 feet. There are currents and counter-currents in the ocean, as in the air, which operate upon the sounding-line, and cause it to run out after the weight has reached the bottom, so that the shock cannot be felt. The oceanic circulation is as complete as that of the atmosphere, and is possibly governed by the same laws; and there appears to be a law of *descent* through "blue water," the same as there is a law of *ascent* through "blue air." The one increases in density downwards as the other increases in density upwards; and the working of this law proves that the sea is not so deep as reports make it. There is a set of currents in the sea by which its waters are conveyed from

place to place through regular and certain channels, traversing from one ocean to the other with *the regularity of the machinery of a watch.* The chief motive power of marine currents is caused by heat. But an active agency in the system of circulation is derived from the salts of the sea-water, by winds, marine plants, and animals. These give the ocean great dynamical force. The force of waves, when breaking against an obstacle, is enormous. Their effective pressure during violent storms has been estimated as high as 6000 lbs. per square foot. The waves breaking against the base of the Eddystone lighthouse, have been known to dash up above its top to 150 feet above the sea-level, and descend like a cataract on its summit. In the great Barbadoes hurricane of 1780, cannon, which had been long lying sunk, were washed far up on shore, and found high and dry on the subsidence of the storm.

"The only reliable deep-sea soundings are those obtained by Brooke's plummet; and the greatest depths at which the bottom of the sea has been reached with this plummet are in the North Atlantic Ocean, and do not show it to be deeper than 25,000 feet, the deepest place being immediately to the south of the Grand Banks of Newfoundland. Now, Mount Everest, in Nepaul, the loftiest point of the Himalaya chain, and the highest mountain in the world, rises 29,002 feet—equal to 5·49 miles,—above the level of the sea; so that, from the top of this mountain to the deepest reliable sea-bottom reached by sounding, gives a vertical height of nearly $10\frac{1}{2}$ miles, or $\frac{1}{7\,7\,\cdot}$rd part of the earth's diameter." *

Then, again, what quantity of water does the sea contain? We are not surprised that philosophers are puzzled to reply;

* See a Contribution to the Builder.

nevertheless, many have been bold enough to make calculations, and the following are the widely different results:—"Kant fixed the middle depths of the seas at half a geographical mile, and Kiel with no better reason at a quarter. De la Methie, who very sparingly allowed only 1,200 to 1,500 feet for the estimate, calculated the quantity of sea-water at about 12,000,000 cubic miles, whilst La Place, by prodigally giving twelve miles to the mean depth of the ocean, attained the prodigious sum of 500,000,000 cubic miles."

One of the most interesting speculations connected with the ocean is the probability that in the beds of the present seas, the edifices and works of nations, whose history is altogether unknown to existing generations, are embedded and preserved:

> "What wealth untold,
> Far down and shining through their stillness lies;
> They have the starry gems, the burning gold,
> Won from a thousand royal argosies.
> Yet more—the depths have more—their waves have roll'd
> Above the cities of a world gone by;
> Sand hath fill'd up the palaces of old,
> Sea-weed o'ergrown the halls of revelry."

The sea consists wholly of salt water, its saltness being nearly uniform in every part. As the sea continually receives the drainage of all the land, besides having in the course of countless ages, washed over and over again the disintegrated materials of successive continents, it must, of course, hold in solution all the saline ingredients capable of being separated and taken up; in fact, in greater or less degree, every soluble substance in nature. By far the greater proportion, however, consists of common salt, and other salts and matters

too numerous to mention; among which the sulphate and carbonate of lime, and silica, however minute the percentage, are yet of vast importance as furnishing all the lime and silica out of which the shells of Molluscs, the structures of coral and other similar animals, and the shells of the siliceous Infusoria, &c. are derived. But, besides these saline and earthy ingredients, metallic salts, in excessively minute quantity, have been shown to exist in sea-water. Thus, it contains so much copper, that clean and polished iron dragged in the wake of a ship, during even a short voyage, has been observed to come up with a film of copper precipitated on it; though it has been asked whether iron so dragged in a ship's wake might not take up a portion of the copper dissolved off the ship's bottom. Silver also is found in combination with the old and worn coppering of ships to such amount as to make it worth while to extract it. It has been computed from some analysis of such copper, compared with the total distance run through by the ship, and the time of its remaining attached, that at least two millions of tons of silver are thus held in solution in the whole ocean.*

The widest oceans abound in organic life at and near their surfaces. Even in very cold latitudes countless millions of creatures of the genus Beroe exist, and others of a larger size, medusæ (or jelly fish), zoophytes, &c. swarm to such an extent as to convert the surface-water in some places into a kind of soup, which furnishes food not merely to small fish, but to cetaceæ of the largest growth; and in tropical regions the sea teems with minute forms of animal life in infinite variety—small molluscs, crustaceous, and luminous creatures, many of them gelatinous; and where the sea is

* Sir John Herschel; *Encyclop. Brit.* Art. Physical Geography.

covered with floating weeds, these become the haunts of a numerous population of species, crabs, sea-slugs, &c. peculiar to them. Thus, whatever be the distance from shore, food is not wanting for such fish as are fitted for its assimilation, and the fish of prey (as is also the case with land animals), are confined by no limits but those which temperature sets to their range.

We now commence our sketch. Observations of marine animals and their localities have led to attempts at showing their distribution to be geographical, laid in five zones, or belts of depth, the life-forms of which vary according to the nature of the sea-bottom and to the vertical depth. The food, &c. afforded by submarine vegetation is different—the texture and constitution also of the sea-bed, as consisting of finer particles carried out far to sea, affects its quality as a nidus for habitation; so that we find the zones of habitable depth in the water to succeed one another with far greater rapidity, and to be confined within far narrower limits than those of atmospheric altitude on land. Each of these zones is characterized by species of animals which belong to no other; and each passes into the other by the intermixture common to several. Proximity to the tropics carries with it increase in the number and variety of species and genera, greater development in size, form, and colour. The shells of the Indian Seas, and the Eastern Archipelago in particular, are prized not merely by the zoologist, but by collectors for their exceeding beauty, brilliancy of colour, and elegance of form. It is in these seas that the pearl fisheries are conducted, the true pearl oyster being confined to them, though pearls of inferior quality are produced also by certain species of mytilus; and Suetonius has recorded that Cæsar's first idea

of invading Britain arose from the report of pearls being found on its coasts. The depth, moreover, has quite as marked influence on the colour of shells as the warmth of the water on the flavour of fish. Below the level, where light can penetrate copiously, the colours of shells wax faint and dilute; and even individuals of the same species taken at different depths exhibit a marked difference in their intensity of colour.*

At the very bottom of the scale of being, and the lowest of these marine animals, are the *Infusoria*, which were discovered by Leuwenhoek in 1675, and derive their name from the fact that they are found "in infusions of every sort of organic matter." They are microscopic, and of a very simple structure. An ounce of sand from the shore of the Antilles has been computed to contain four millions of one species. Some of the *Infusoria* are robed in the most brilliant colours, more especially, the *Gonium pectorale*, or High Priest's breastplate—"sixteen oval green masses disposed regularly on a transparent shell of square form, like emeralds set in a plate of the purest glass." This wonderful appearance is, however, by some referred to the vegetable kingdom.

The workings of these minute creatures, to which we have already adverted, will be better understood by the following instances recorded in Page's *Advanced Text-Book of Geology*, thus: "It has been ascertained by Ehrenberg that infusorial accumulations are now choking up the harbour of Wismar in the Baltic; that similar formations are effecting changes in the bed of the Nile at Dongola in Nubia, and in the Elbe at Cuxhaven; and that many of our ochraceous bog-iron ores consist chiefly of the siliceo-ferruginous shields of these

* Sir John Herschel; *Encyclop. Brit.* Art. Physical Geography.

minute and myriad animalcules. The berg mahl (mountain meal) of Iceland and Lapland, the "edible clay" of Brazil, and the "white earth" of the American Indians, are evidently of the same nature, and these are spread over many miles in extent and several feet in thickness. According to Pictet, 6,000 shells of Foraminifera have been counted in an ounce of sand from the shores of the Adriatic; d'Orbigny found 3,840,000 in the same quantity from the shores of the Antilles; and every cast of the sounding-lead alike in the Atlantic, Pacific, and Australian seas, brought up thousands to the naturalists of the United States' Exploring Expedition. The bed of the Atlantic Ocean, at a depth of two miles was found, in the deep-sea soundings made for the purpose of laying down the telegraphic cable, to be composed of little else than these calcareous shells. And of the enormous chalk formation with which we are familiar in England, a large part, perhaps the largest, consists of foraminiferated shells, some perfect, others in various stages of disintegration. Another class, discovered by Ehrenberg, is so small, that a cubic inch contains no less than 41,000 millions of individual organisms! Yet these minute bodies present, under a sufficient magnifying power, the most beautiful and definite characters, no less recognizable and distinctive than the calcareous shells of Molluscs.

Captain Maury thus poetically describes the condition of Infusoria at vast depths of ocean:—"Having thus discovered that the most frail and delicate organisms of the sea can remain in its depths for an indefinite length of time without showing a single trace of decay, we find ourselves possessed of a fact which suggests many beautiful fancies, some touching thoughts, and a few useful ideas; and among

these last are found reasons for the conjecture that the gutta percha or other insulating material in which the conducting wires of the sub-Atlantic telegraph and other deep-sea lines are incased, becomes, when lodged beyond a certain depth, impervious to the powers of decay; that, with the weight of the sea upon them, the destructive agents which are so busy upon organic matter in the air and near the surface cannot find room for play. Curious that destruction and decay should be imprisoned and rendered inoperative at the bottom of the great deep! * * The unabraded appearance of these shells, and the almost total absence among them of any detritus from the sea or foreign matter, suggest most forcibly the idea of perfect repose at the bottom of the deep sea. Some of the specimens are as pure and as free from the sand of the sea as the freshly fallen snow-flake is from the dust of the earth. Indeed, these soundings suggest the idea that the sea, like the snow-cloud with its flakes in a calm, is always letting fall upon its bed showers of these microscopic shells; and we may readily imagine that the 'sunless wrecks,' which strew its bottom, are, in the process of ages, hid under this fleecy covering, presenting the rounded appearance which is seen over the body of the traveller who has perished in the snow-storm. The ocean, especially within and near the tropics, swarms with life. The remains of its myriads of moving things are conveyed by currents, and scattered and lodged in the course of time all over the bottom. This process, continued for ages, has covered the depths of the ocean as with a mantle, consisting of organisms as delicate as the macled frost, and as light in the water as is down in the air."

The unit of existence, if we may use the expression, is a

cell. The cell is a small pellucid globule, which contains a kernel, which again contains a granule. The kernel is called a nucleus, and the granule a nucleolus. All organic substances are made up of these cells. The bodies of the lowest animals are little more than aggregations of them. The next most simple structures are *cilia*, which may be considered to be the walls of cells drawn out to a point. The simplest of all animals, one of the *Infusoria*, which has been poetically called the Twilight Monad, because it stands between the light of life and the darkness of nonentity, is little more than a cell, furnished with a single *cilium*. It is a round transparent speck, $\frac{1}{12000}$th part of an inch in length: this is the smallest animal known.

The marine animals, which tenant these shells, are so minute, that to say they bear the same relation to the coral animal that the mouse does to an elephant, would be to overrate their dimensions. These atoms are found in all parts of the world, both in fresh and salt waters. Their influence on the earth in which we live is almost beyond belief. Dr. Montgomery observes that the whole bottom of the ocean seems to be in a great measure made up of these bodies; and Sir John Ross and other Arctic explorers speak of a large bank, called the Victoria Barrier, 400 miles long and 120 miles wide, comprised almost entirely of these atoms. The town of Richmond, in the United States of America, is built upon a stratum of these bodies, 20 feet in thickness. In California and America generally, in Bohemia, throughout Europe and Africa, and even in our own country, similar deposits have been found. Mr. Gosse was examining a sounding from the bottom of the ocean, at the depth of 2000 fathoms, on the exact spot where the Atlantic Telegraph

unfortunately gave way, when he discovered a great number of these atoms. Mr. George Jeffreys has also shown that, in the Mediterranean line, the cable, as well as its inclosure of gutta percha; was pierced by the marine animals of perforating habits, at a depth of between 60 and 70 fathoms.

Mr. Jeffreys, while investigating the causes of failure in submarine telegraphy, ascertained there to have been, during the survey of the North Atlantic line, only one piece of wood met with in the Arctic Sea which showed any marks of having been perforated by marine animals. It had formed part of a fir-tree, and was picked up by the *Fox*, on 13th September, 1860, off the east coast of Greenland: it had been much rubbed and frayed, probably by attrition against loose or floating ice. Mr. Jeffreys found the perforations to have been caused by a kind of *Annelid;* and they extended to a considerable depth, although they were of different nature from the tunnels bored by any kind of Teredo. Sir John Ross, in his Arctic Voyage, 1819, records, in many of his deep-sea soundings, living sea-worms, or Annelids, occurring at depths varying from 192 to 1000 fathoms. At 800 fathoms' depth Sir John found a beautiful *Caput Medusæ*, which is still to be seen in the British Museum; it measured 2 feet in length, when fully expanded. A small Star-fish was found attached to the line, below the point marking 800 fathoms. Animals of a higher degree of organization, such as Molluscs and Crustaceans, were also procured by Sir John Ross, during the same Expedition, at rather less depths, in Baffin's Bay.

The deep sounding-apparatus by which such interesting additions have been made to our knowledge of ocean's depths and its countless creatures, is not an invention of our day. Captain Maury tells us that "the honour of the first attempt

to recover specimens of the bottom from great depths belongs to Peter the Great of Russia. That remarkable man and illustrious monarch constructed a deep-sea sounding-apparatus specially for the Caspian Sea. It was somewhat in the shape of a pair of ice-hooks, and such as are seen in the hands of the ice-man, as, in his daily rounds, [in New York,] he lifts the blocks of ice from his cart in the street for delivery at the door. It was so contrived that, when it touched the bottom, the plummet would become detached, and the hook would bring up the specimen."

Dr. Wallich has ascertained that multitudinous minute forms exist in Africa, in a free swimming condition, in various regions of the ocean, and at various depths from the surface downward: they afford sustenance to immense numbers of molluscous and crustaceous animals, which, in their turn, become the food of the most gigantic creatures of "the vasty deep."

In speaking of the prodigious fecundity of aquarian life, Schleiden says: "We marvel at the hen which will lay 200 eggs in a year, but the eggs of a fish must be counted by hundreds of thousands. In every mouthful the whale swallows thousands of the tiny *Clio Borealis*, which forms its chief nourishment. Frequently, on the coasts of Greenland, the sea is coloured for 10 or 15 miles in breadth, and 150 to 200 miles in length, with tiny Medusæ."

The rapid multiplication of microscopic organisms, is in some cases, accompanied by a remarkable tenacity of life from a state of apparent death, after being dried for twenty-eight days in a vacuum with chloride of lime and sulphuric acid, and after being exposed to a heat of 248°. These instances are recorded by Ehrenberg, who also relates a case of

the revival of animalcules that had been dried during a space of many years.

Minute examination discloses occasionally prodigious accumulation of the microscopic shells, that surprise us no less by their abundance than by their extreme minuteness: the mode in which they are sometimes crowded together, may be estimated from the fact that Soldary collected from less than an ounce and a half of stone found in the hills of Casciana, in Tuscany, 10,454 microscopic chambered shells. Of several of these, four or five hundred weigh but a single grain; of one species he calculates that a thousand individuals would scarcely weigh one grain. He further states that some idea of their diminutive size may be formed from the circumstance that immense numbers of them pass through a paper in which holes have been pricked with a needle of the smallest size.

It has been eloquently and truthfully said that "the link which these minute and wide-spread organisms constitute between the life phenomena of far-distant ages and those of the present time is, indeed, a justification of the remark of their discoverer, that '*inferior as they are in individual energy to lions and elephants, they are in their united influences far more important than all these animals.*' It is curious to think that the tiara of the empress is indebted for its splendour, and the wheat-stem for the glazing which preserves it from the mildew, to the existence, milleniums back, of minute living creatures, whose being was not even suspected a quarter of a century ago."

Before we part with this lowest class of animals, we may notice a family of organisms below both animals and plants: they are termed *Protozoa*, which suggests their character, as participating in life of the very lowest degree. Their struc-

ture is such that it can receive fluid matter from without, alter its nature, and add it to the alterative structure. But they do not, like plants, exhale oxygen, nor does their tissue, like that of plants, yield to chemical analysis certain ternary compounds. Nor do they, like animals, inhale oxygen, and exhale carbonic acid, or receive their nutritive matter by a mouth. Hence they are placed between the animal and the plant, the boundary between which is difficult to trace, since they shade into each other almost imperceptibly, and it is more than doubtful whether there is really any boundary at all. The most familiar instance of these Protozoa is the common *Sponge*, the soft organic portion of which is so important to our daily comfort. The flesh is a transparent slime, which is got rid of when the sponge is prepared for sale. When alive, the sea-water is perpetually drunk in by one set of holes, and poured out by another, so that a constant current is kept up through the body of the animal.*

* The hard sustaining part, from which the "Sponge" has been detached renders this family of organisms an object for the consideration of the palæontologists. These sustaining parts are sometimes horny, sometimes in the shape of fine siliceous *spicula*, and sometimes calcareous. One of the calcareous sponges constantly appears in the Brighton brooch pebbles, displaying in its polished section a spiral tube winding round a central cavity. Another forces itself upon the notice of every excursionist who remarks the regular layers of flints wherever he comes to a cutting in the downs. These layers are the silicified remains of a large crop of sponges which grew myriads of years ago! The Kentish rag is full of siliceous *spicula* from fossil sponges, and the green sand of Blackdown is famous for a kind of a very peculiar shape, something like a pear on a long stem, which latter part has been sometimes mistaken for a bone. This species is found in the neighbourhood of Farnham, infiltrated with phosphate of lime, and has been used in agriculture as a manure. Altogether, no less than 36 genera and 427 species of fossil sponges have been already enumerated; "and this," says Professor Owen, "is probably only a

Immediately above the *Infusoria* are the *Polypes*, a class of animals which, like the preceding, were for the most part unknown to the ancients, who gave the name Polypus to a family nearly allied to the cuttle-fish, which still retains in France the name of *Poulpe*. To the class of *Polypes* belong many marine creatures, which were, till very recently, supposed to be plants or minerals. Some thought they were branching crystallizations—some believed them to be sea-weeds, and fancied the little gelatinous bodies which contracted when they were removed from the water, to be buds or flowers. Even in 1727, when Reaumur communicated Peysonnel's views as to their animal nature, to the Academy of Sciences, in Paris, he felt himself obliged, in justice to the ingenious physician of Marseilles, to conceal the name of the author of so daring an hypothesis.

Polypes are divided into two great sections—Anthrozoa and Bryozoa. Familiar examples of the first section are the phosphorescent Sea-pen, the common Sea Anemone; and the Madrepores, sometimes known as Mushroom Corals, the beautiful lace-coral, or *Retapores*, called by the French *Manchette de Neptune*, (Neptune's Ruffle,) and not uncommon round our coasts, belong to this second section. "These creatures, humble as they are, have had a great duty to discharge since time began. To them we owe the mighty barrier-reefs of the Pacific, and the atolls, those 'fairy rings of the ocean,' whilst whole districts are composed of their fossil remains. The extraordinary beauty of many of the British species is an open secret, known to every one who interests himself in the wonders of the sea, but overlooked

small proportion of the actual number in museums."—See Prof. Owen's great work on *Paleontology*.

by hundreds who daily crush beneath their feet the delicate polypidoms, or polype-houses, which lie thick in every mass of sea-weed thrown up by the tide." Professor Rymer Jones has thus described their life and labours: "Fixed in large arborescent masses to the rocks of tropical seas, or in our own climate attached to shells or other submarine substances, they throw out their ramifications in a thousand beautiful and plant-like forms; or, incrusting the rocks at the bottom of the ocean with calcareous earth, separated from the water which bathes them, they silently build up reefs and shoals, justly dreaded by the navigator; and sometimes giving origin, as they rise to the surface of the sea, to islands, which the lapse of ages clothes with luxuriant verdure, and peoples with appropriate inhabitants." The *Hydra* of our ponds is a polype, a little round knob of jelly or duckweed, about which, a hundred years ago, all the *savans* in Europe were talking, and were electrified by its mode of increase. In summer it shoots forth, from various parts of its body, little warts or knobs, which increase rapidly, and in a few days assume the form of the parent animal, each furnished with a circle of tentacles, though attached at its lower end. In process of time, the connexion between the child and the parent ceases, and the young hydra sets up for itself. The strangest experiments may be safely tried with these creatures. They may be cut into pieces. They may be grafted on each other, and some may be turned inside out like a glove; and, more tenacious of life than the Lernæan monster, they will be all the better for these operations.*

Professor Jones recommends the sea-side naturalist who is in search of the Sea Anemone to provide a double-headed

* Saturday Review, No. 68.

hammer, a long iron chisel, an oyster-knife, an old ivory paper-knife, and a small net, made by twisting a piece of strong wire into a circle, with a tail to it, and fastening a bag of muslin round the edge of the ring. The hammer and chisel are indispensable. Many Anemones delight in rock-holes, and it is impossible to get them out without chiselling away a portion of the rock to which they adhere. It is necessary to be careful in separating them from the rock; for, if they are at all lacerated, they mortify, corrupt the water in which they are placed, and finally die. On finding a specimen which the collector may be anxious to preserve, it may be wrapped in moist sea-weed, or in a handkerchief wetted with sea-water, where it will be quite safe for many hours in a small saucer, which can be afterwards exchanged for a larger vessel. A small quantity of water suffices for it, in case of necessity, wherein it may be kept uninjured for a long period in a vessel of very moderate capacity, but entirely covered by water, or frequently washed with it. There is no difficulty either in feeding or preserving it, such is the variety of substances it devours. The Actinia must be deemed a long-lived animal. A specimen of the Sea Anemone is figured by Sir J. Dalyell, which he had kept in a state of captivity for twenty years, and which could not have been under thirty years old; and another, apparently of equal age with the former when taken, had lived for thirteen or fourteen years in his possession; nevertheless, both these patriarchal specimens were in full vigour, and likely to survive for years longer. It is almost a law that the slower the process of life, the longer is the individual existence.

Madrepores are among our splendid south-coast rarities. Mr. Kingsley describes a parasite on the lip of one of these

creatures, as "rooted to one spot through life and death; but in its infancy it was a free swimming animal, hovering from place to place upon delicate cilia, till, having sown its wild oats, it settled down in life, built itself a good stone house, and became a landholder, or rather a *glebæ adscriptus*, for ever and a day." The Madrepore is, by profession, a scavenger and a feeder on carrion.

Cellepore Corals are found round the coast; and most eloquently does Mr. Kingsley describe them as "all tiny things, the lingering, and, as it were, expiring remnants of that great coral world, which, through the abysmal depths of past ages, formed here in Britain our limestone hills, storing up for generations yet unborn, the materials of agriculture and architecture. Inexpressibly interesting, even solemn, to those who think, is the sight of these puny parasites, which, as it were, connect the ages of the zones; yet not so solemn and full of meaning as that tiny relic of an older world, the little pear-shaped Turbinolia, (cousin of the Madrepores and Sea Anemones,) found fossil in the Suffolk crag, and yet still lingering here and there alive in the deep water off Scilly, and the west coast of Ireland, possessor of a pedigree which dates, perhaps, from ages before the day in which it was said, 'let us make man in our own image.'" Hear the context: "Yes; it is this vision of the awful permanence and perfection of the natural world, beside the wild flux and confusion, the mad struggles, the despairing cries of that world of spirits which man has defiled by sin, which would at moments crush the naturalist's heart, and make his brain swim with terror, were it not that he can only see by faith, through all the abysses and the ages, not merely

Hands,
From out the darkness shaping man;

but above them a living countenance, human and yet divine; and can hear a voice which said at first, 'Let us make man in our own image;' and hath said since then, and says for ever and for ever, 'Lo, I am with you always, even to the end of the world.'"

Wonderful is it to reflect that thousands of miles of coral reefs, forming immense barriers against the furious storms of the ocean, the clear and beautiful lagoons which interfere between the reefs and the main land, and the numerous coral islands on which palm and other trees flourish, are all produced by little soft-bodied sea-anemones, tiny atoms of pulp, apparently helpless beings of jelly, smaller than the smallest flower which may be found in our fields or gardens. The coral shrubs and groves which rise from the blue transparent depths, are, under the water, covered with a layer of jelly-like flesh, of many brilliant colours, formed by the crowding together of myriads of the tiny architects. These wonderful architects have been taken in the Dead Sea: although this sea is named from the belief that no living object has been found in it, it is certain that some fine specimens of the wonder-working coral animal, have been taken in the "Dead" waters. This fact is the more interesting because this species is not found in the Mediterranean, but belongs to the Red Sea, which has but few organic forms in common with the Mediterranean. Humboldt had remarked that in France a sea-fish, a species of *Pleuronectes*, advances far up the rivers into the interior of the country, thus becoming accustomed to gill-respiration in fresh-water; so we find that the above coral animal has a not less remarkable flexibility of organization, since it lives in the Dead Sea, which is over-saturated with salt, and in the open ocean near the Seychelle Islands.

Multitudes of strange creatures may be seen either over or through the coral shrubs. Fishes of gorgeous hue, elegant shells with spotted inhabitants carrying them, nimble prawns of crimson and yellow, long gliding green worms, and purple sea-urchins with enormous spines, here find their home, and live at ease beneath an unclouded sun: such is the picture drawn by Mr. Gosse, the naturalist. As an instance of the progress of this workmanship, it is related that a channel being dug through a coral reef at Keeling Atok, in the Pacific Ocean, for a passage for a schooner that had been built on the island, from the lagoon into the sea, it was found ten years afterwards to be almost choked up with living coral. An interesting experiment was made at Madagascar by securing several masses of living coral with stakes three feet below the water-level; seven months after which they were found reaching nearly to the surface, firmly cemented to the rock, and extending nearly three feet in one direction; this must have been a remarkably rapid growth. Instances of them are abundant in the British Islands. The limestone of Wenlock Edge is a coral reef, 30 miles in length; so are the lofty limestone Cheddar Cliffs; and so too are the shores of Lough Erne.

Sir John Herschel describes these formations as the work of those singular organisms in the tropical seas, which secrete from the sea-water the nidus which they inhabit in the form of continuous rocky masses, perforated according to regular patterns, and known by the name of *Coral*. The animals themselves live and work only within certain very moderate limits of depths not exceeding 90 fathoms; and whether those now living are to be considered as successors or prolongations of those which have perished *in situ*, does not seem to be well made out.

The Coral Formations are chiefly confined to the Indian and Pacific Oceans, between the parallels of 30° north and south. The Arabian and Persian Gulfs, and the Red Sea, are full of them; and between the coasts of Madagascar and Malabar, the whole ocean may be considered as a great coral sea. Along the east coast of Australia, and stretching thence to New Guinea, they form dangerous barrier reefs, which prevent all access to the coast, except through narrow channels occurring only at rare intervals. But the most curious and striking peculiarity of the coral formations is their tendency to crown every summit rising up from deep water, and to form, upon sunken rocks, circular basins, or lagunes, called atolls, surrounded on every side with water of unfathomed depth, and shelving off in the most precipitous manner.

It has been considered, with probability, that these atolls crown the craters of extinct volcanoes; and from the excessively sudden and precipitous manner in which many of them in the Pacific spring up from deep water, the lower portions being formed of *dead* coral, (for the animal lives and works only at or near the surface,) an argument almost irresistible has been drawn by Mr. Darwin in favour of a slow but continual subsidence of the bottom of the ocean in which they occur, the animals constantly raising the summit to the surface as the base subsides. The upper portion of their work is battered by the sea, which heaps up the broken fragments on the windward side, leaving generally an opening into the lagune to leeward, and thus forming, as it were, harbours of refuge of great security, with free access at all times. This peculiarity has been insisted on by Sir Charles Lyell as an additional and very cogent argument for their gradual subsidence, as it is difficult to imagine any other course by which

the leeward opening could be constantly kept unobstructed. It is one of the peculiarities of these animals always to build perpendicularly upwards, which explains the precipitous character of the external wall of their lagunes, and serves, in conjunction with the great depth from which they rise, to give some idea of the duration of the period in which the subsidence of their foundation has been in progress—such steepness being of extreme rarity on coasts where no coral exists, and where the usual action of the sea, except on the hardest granite, invariably shoals the water into a more or less gradual declivity.

The appropriation of the building materials by the animal has been thus nicely demonstrated by Prof. Forchhammer, who has analyzed sea-water from various parts of the globe, and who finds the quantity of lime in the Caribbean Sea remarkably small, being only 247 parts in ten thousand, while in the Cattegat it amounts to 371 parts in ten thousand. He is disposed to attribute this difference to the many coral banks among the West India Islands, which *appropriate the lime*, and lower the per centage in the sea-water.

James Montgomery, in his poem the *Pelican Island*, thus beautifully describes this process:

> On a stony eminence, that stood
> Girt with inferior ridges, at the point,
> Where light and darkness meet in spectral gloom,
> Midway between the height and depth of ocean,
> I mark'd a whirlpool in perpetual play,
> As though the mountain were itself alive,
> And catching prey on every side, with feelers
> Countless as sunbeams, slight as gossamer;
> Ere long transfigured, each fine film became
> An independent creature, self-employ'd,
> Yet but an agent in one common work,

The sum of all their individual labours.
Shapeless they seem'd, but endless shapes assumed:
Elongated like worms, they writhed and shrunk
Their tortuous bodies to grotesque dimensions;
Compress'd like wedges, radiated like stars,
Branching like sea-weeds, whirl'd in dazzling rings;
Subtle and variable as flickering flames,
Sight could not trace their evanescent changes,
Nor comprehend their motions, till minute
And curious observation caught the clew
To this live-labyrinth,—where every one,
By instinct taught, perform'd its little task;
—To build its dwelling and its sepulchre,
From its own essence exquisitely modelled:
There breed, and die, and leave a progeny,
Still multiplied beyond the reach of numbers,
To frame new cells and tombs; then breed and die,
As all their ancestors had done,—and rest,
Hermetically sealed, each in its shrine,
A statue in this temple of oblivion.
Millions of millions thus, from age to age,
With simplest skill, and toil unwearyable,
No moment and no movement unimproved,
Laid line on line, terrace on terrace spread,
To swell the heightening, brightening, gradual mound,
By marvellous structure climbing tow'rds the day.
Each wrought alone, yet altogether wrought,
Unconscious, not unworthy, instruments,
By which a hand invisible was rearing
A new creation in the secret deep.
Omnipotence wrought in them, with them, by them;
Hence what Omnipotence alone could do,
Worms did. I saw the living pile ascend,
The mausoleum of its architects,
Still dying upwards as their labours closed;
Slime the material, but the slime was turn'd
To adamant, by their petrific touch;
Frail were their frames, ephemeral their lives,
Their masonry imperishable.

Above the *Polypes* come the *Acalephæ*, or Sea Nettles, several species of which tribe are sure to attract the attention

of visitors to the sea-shore. They move in the water by contraction and expansion, and are perfectly helpless when cast upon the beach. Their name is derived from the burning pain which many of them cause when handled. The cause of this sensation is probably the irritation occasioned by some acrid fluid adhering to certain thread-like organs which, when the animal is not disturbed, lie rolled up in a little oval vesicle, and are pushed forth, when it is pressed upon or injured. Some of these are phosphorescent. The Arabians on the Red Sea, according to Ehrenburg, call the Medusæ, which belong to this class, Sea-candles; and the brilliant oceanic illuminations, which so many voyagers describe with rapture, are often due to these minute creatures, which are not larger than a pin's head.

The *Echinodermata*, or Urchin-skins, are the next in order. This class includes all the Echini, or sea-urchins, the star-fishes, the sea-cucumbers, and many others. They are found in all parts of the world. In our own seas are many of great beauty. The Brittle Stars, so called because they break themselves to pieces, if not prevented by being killed almost immediately on being removed from the sea, are among the prettiest. Mr. Kingsley describes the *Echinus milliaris*, found on Paignton Sands, "with his extraordinary feeding mill (for neither teeth nor jaws is a fit word for it,) enclosed within an ever-growing limestone castle, to the architecture of which the Eddystone and the Crystal Palace are bungling heaps; without arms or legs, eyes or ears, and yet capable, in spite of his perpetual imprisonment, of walking, feeding, and breeding, doubt it not, merrily enough. But this result has been attained at the expense of a complication of structure which has baffled all human analysis and research into final

causes." . . : "Conceive a Crystal Palace, (for mere difference in size, as both the naturalist and metaphysician know, has nothing to do with the wonder,) whereof each separate joint, girder, and pane, grows continually without altering the shape of the whole; and you have conceived only one of the miracles embodied in that little sea-egg, which the Divine Word has, as it were, to justify to man His own immutability, furnished with a shell capable of enduring fossil for countless ages, that we may confess Him to have been as great when His first Spirit brooded on the deep, as He is now, and will be through all worlds to come."

The finding of the Sea-cucumbers beneath a slab of red sandstone, the weed-covered surface of which shows that the surge has not shifted it for years, is an interesting incident. Having raised it, you first see a group of milk-white slugs, from 2 to 6 inches long, cuddling snugly together; eating and breathing are suspended till the return of the tide; but, having put a little bundle of these creatures in a jar of salt water, each will protrude a large chocolate-coloured head, tipped with a ring of the feathery gills, looking very much like a head of *curled kale*, but of the loveliest white and primrose; in the centre whereof lies *perdu* with sturdy teeth, if they and the worthy fellows inside have not been lately got rid of, and what you see be not a mere bag, without intestine or other organ; but only for the time being. Mr. Kingsley's apostrophe to this curious little creature is very characteristic. "Happy Holothuria!" he says, "who possesses really that secret of everlasting youth, which ancient fable bestowed on the serpent and the eagle. For when his teeth ache, or his digestive organs trouble him, all he has to do is just to cut up forthwith his entire inside, and *faisant*

maigre for a month or so, grow a fresh set, and then eat away as merrily as ever. His name is *Cucumaria Hyndmanni*, named after Mr. Hyndmann of Belfast, his first discoverer; but he has many a stout cousin round the Scotch coast, who submits, among the northern fishermen, to the rather rude and undeserved name of sea-puddings; one of which grows in Shetland to the enormous length of three feet, rivalling there his huge congeners, who display their exquisite plumes on every tropic coral reef."

Above the *Echinodermata* are the *Entozoa*, or internal worms, creatures very different from each other, although they agree in the accident of their habitation being the bodies of other animals. Most of the species occur in birds and fishes. More highly organized, and consequently, more dignified than the internal worms, some of which attain very considerable dimensions, are the *Rotatoria*, or wheel animalcules, which derive their name from the vibrating cilia that are set on the magin of a disc at the anterior extremity of the body. The motion of the cilia produces, by an optical illusion, the impression of a wheel rapidly rotating. They are capable of reviving, under the stimulus of fluid, after life has been apparently long extinct.

Above these microscopic creatures are the *Annulata*, or ringed worms, to which belong the common leech, the earthworm, and the serpulæ which dwell in twisted sheaths, compacted with bits of shell or grains of sand, which are so continually dredged up from the sea on stones, old bottles, or others objects which have been for some time submerged: those who have seen the relics from the wreck of the Royal George will remember several specimens of these accretions. Many of the *Annulata* have, from their great beauty, received

from admiring naturalists, the names of mythological personages. The classical student is amused to meet with Clymene and Amphitrite in a group of life so humble. The little Sea-mouse is called Aphrodite (the Greek name of Venus,) by some, and Halithea by others.

The *Crustaceans* are named from their external covering, which is generally hard, and contains a large amount of carbonate of lime. To this class belong not only the common crab, the lobster,* and the cray-fish, but the acorn barnacles, or sea-tulips; and the trilobites, so common as fossils in some localities. There were anciently no less than 400 species of this animal whose shell suggests the notion of a crab's at first sight, although it was really only a shield for the head of its former possessor. These creatures—the Trilobites—are remarkable for the number of facets of the eye: in one species, each eye is computed to have 6,000. Frequently, in the fossil specimens the lenses are well preserved, and visible without the use of the microscope. It is curious that, up to the present time, there is no evidence of the means by which the Trilobites exercised the power of locomotion. No indications of limbs of any kind have as yet been detected, although the size of the animal was considerable, in some instances as much as eighteen inches in length.

We next reach the immense tribe of *Molluscs*, (soft animals) which are divided into three classes,—the Tunicates, the Conchifers or Bivalves, and the Molluscs proper. The Tunicates have no shells, but are inclosed in a sac of various thickness and hardness. To this class which, in thirty years,

* Some of the crustaceans of early geological times were of terrific size. A huge lobster, 7 feet in length, and others which attained a yard, inhabited the Old Red Sandstone.

increased from 5,000 to 20,000,—belong the Ascidians, one family of which has received the name of Pyrosoma, (fire-body,) because they were first discovered by voyagers on the Atlantic Ocean, under the Tropics, when, in a dark night, numerous specimens appeared to form a broad band of light across the sea. The Bivalves, with their numerous families, lie immediately above the Tunicates. Many of them are familiar to every one, and the brilliancy of the colours of their shells rendered them objects of interest long before most other branches of Natural History attracted even the passing attention of the many.

The Molluscs proper, all which have a head more or less distinct from the rest of the body. They have special organs for touch and for sight, sometimes also for hearing. The most dignified of this class are the Cephalopods, (Chambered Shells,) animals with their organs of motion arranged round the head; and the highest family in the whole class is that of the Octopoda: this includes the famous Nautilus, or Argonaut, which the ancients, not understanding very well its anatomy, believed to float in still weather on the surface of the sea, using its fin-like arms for a sail, the office of steering being generally served by the tail. The shell is no thicker than paper, and divided into forty compartments or chambers, through every one of which a portion of the body passes, connected, as it were, by a thread. The shell being exceedingly thin and fragile, the tenant has many enemies, and among others, the Trochus, who makes war on it with unrelenting fury. Pursued by this cruel foe, it ascends to the top of the water, spreads its little sail to catch the flying breeze, and rowing with all its might, scuds along, like a galley in miniature, and often gets away from its more cumbrous pursuer. Sometimes, however,

the Trochus gains upon it, and escape appears impossible; but when the little animal, with inexplicable ingenuity, suddenly and secretly extricates itself from his tortuous and fragile dwelling, the Trochus turns to other prey. The Argonaut then returns to tenant and repair his little bark; but it too often happens, that before he can regain it, it is by a species of shipwreck, dashed to pieces on the shore. Thus, wretchedly unhoused, the animal seeks some corner "where to die," but rarely until after he has made great exertions to establish himself anew. What a picture of virtue nobly struggling with misfortune! Only three or four species of these animals exist in modern seas; but of fossils there are no less than 1,400, now extinct. Of these, in point of magnitude, the huge Ammonites of three feet diameter, and the singular *Orthocerata*, who lived habitually in a nearly vertical position, carrying a straight shell, like the horn of the fabulous Unicorn, six feet in length, look like giants by the side of the graceful paper Nautilus. There is, however, a great difference between the Ammonites and this elegant little creature in the internal arrangement of the shell. The siphuncle, or air-tube, which runs along the spiral, by means of which the animal is enabled to rise or sink at pleasure, is in the former central or internal, whereas in the Ammonites it ran along the outer circumference. In both cases, however, it is central as regards the animal; so that the shell of the Ammonite, when feeding, curled over it in the same direction as the tail of a pug-dog. The Ammonite, too, was provided with a kind of lid to shut itself in, not like the fibrous "hood" of the Nautilus, but calcified, so as to have been sometimes mistaken for one member of a bivalve shell.

The curious fossil, named *Belemnite*, from its resemblance

to a spear-head, is really only a portion of the skeleton of a Cephalopod, corresponding to the pointed *Mucro*, or point of the bone of a Cuttle-fish. Whether the animal to which the Belemnite belonged possessed an ink-bag, like the modern Cuttle-fish is not certain; but, in other fossil species of the same order, the fact has been distinctly made out. At Lyme Regis, bags containing the solidified ink have been found associated with the fossil bone. Dr. Buckland sent some of this substance to his friend, Sir Francis Chantrey, who executed with it a small drawing, which a painter pronounced most excellent sepia. These fossil bags assisted the Cephalopods to which they belonged in concealing themselves from the formidable enemies, now extinct, which inhabited the same seas with them. These were Enaliosaurians, huge lizards, of which the well-known Plesiosaurus is one example.

To the great Cuvier we owe our knowledge of the Molluscs. He had already bestowed much of his time in studying Natural History, collecting specimens, and drawing and colouring insects, birds, and plants; and his residence in Normandy,* being near the sea, the study of marine animals became a part of Cuvier's occupation. He compared the living species with the fossil remains found in the neighbourhood; and the dissection of a species of Cuttle-fish led him to study the anatomy of the Molluscs, and to reduce to order this hitherto neglected branch of Zoology. We have still a few groups to glance at.

Mr. Gosse has pictured some strange assemblages of various creatures, which an easterly gale has swept from the populous shallows of Torbay, and cast up, high and dry, on Paignton Sands. Here may be seen shell-beds of various forms and

* See page 24, *ante*.

colours: the purple and olive wreaths of wrack, and bladder-weed, and tangle (oar-weed, as they call it in the south), and the delicate green ribbons of the Zostera, (the only English flowering plant which grows beneath the sea;) long white razors; delicate green-grey scimitars; tapering brown spires; tufts of delicate yellow plants, like squirrels' tails; and lobsters' horns, and tamarisks, and fir-trees; little pink-stringed pears; tiny babies' heads covered with grey prickles instead of hair; the great red star-fish, which Ulster children call "the bad man's hands;" and the great whelks which the youth of Mussulburgh know as roaring buckies. Here may be seen the red capsicums poking, snapping, starting, crawling, tumbling evitably over each other, rattling about the huge mahogany cockles, as big as a man's two fists, out of which they are protruded. You may see tens of thousands of this great cockle in every cove for miles: "every heavy winter's tide," says Mr. Kingsley, "brings up an equal multitude—a seeming waste of life, which would be awful in our eyes, were not the Divine Ruler, as His custom is, making this destruction the means of fresh creation, by burying them in the sands as soon as washed on shore, to fertilize the strata of some future work." In size and colour this cockle resembles one of those great red capsicums which hang drying in every Covent Garden seedsman's window. Its motions resemble dancing; and a certain countess seeing two of them waltzing about a plate, exclaimed: "Oh dear! I always heard that my pretty red coral came out of a fish, and here it is all alive!" The little pink pears above mentioned are a delicate sea anemone; they adhere by thousands to the loose stones among the sand, and when put into a basin of salt water, they will expand into a compound flower, whose "snake-

locked" arms are all encircled with pellucid greys and browns, till they look like a living mist, hovering above the pink-striped cylinder of the body. Elsewhere, Mr. Gosse discourses of the myriads which people every ledge of these flat New Red Sandstone rocks, which, if torn up with the crow-bar, discloses in its cracks and crannies nests of strange forms, which shun the light of day: "beautiful Actiniæ fill the tiny caverns with living flowers; great Pholades bore by hundreds in the softer strata; and whenever a thin layer of muddy sand intervenes between two slabs, long Annelid worms of quaintest forms and colours leave their horizontal burrows, among those of that curious and rare radiate animal, the Spoonworm, an eyeless bag about an inch long, half bluish grey, half pink, with a strange scalloped and wrinkled proboscis of saffron colour, which serves, in some mysterious way, soft as it is, to collect food, and clear its dark passage through the rock.

"See, at the extreme low-water mark, where the broad olive fronds of the Laminariæ, like fan-palms, droop and wave gracefully in the retiring ripples, a great boulder will serve our purpose. Its upper side is a whole forest of sea-weed, large and small; and that forest, if you examined it closely, as full of inhabitants as those of the Amazon or the Gambia."

Professor Jones has beautifully described the "Phosphorescence of the Sea." "Few persons who visit the sea-side," he says, "have not at some time or other, more especially during the summer season, had occasion to observe, while walking by night upon the shore, or else, while enjoying the breeze upon some pier-head or sea-overhanging cliff, a phenomenon as beautiful as it is astonishing. The waves, as they

come rolling in, seem fringed with fire; and when they break upon the shore, burnt into liquid flame which glides along, still spreading as it flows, until it laves the sands with light, and then slowly retiring, leaves a track of shining sparkles glittering on the strand. If witnessed from a boat, or from a steamer's deck, the scene is still more wonderful: the heaving waves around seem to burn like phosphorus, emitting pale and ghostly splendour; the silent oars are raised dripping with living diamonds; or if a hand should be immersed in the refulgent water and again withdrawn, the glowing sparks, like tiny stars, stick to its surface, and are shaken off in brilliant scintillations. The splashing wheels stir up a sheet of light; the wake of the vessel flames behind as if it were the tail of some vast rocket, and the labouring ship appears to wallow in a fiery foam.

In our own climate, this luminous appearance is seldom witnessed in such perfection: more frequently, when the water is slightly agitated by the winds and currents, it only shows its elfin scattered sparkles mingled with the spray of the sea, and in the froth created by the way of the ship. These sparkles or luminous points vary in magnitude, and often continue to shine for some moments as they pass the sides of the vessel or follow in its track. The kind of light thus exhibited is sometimes extremely brilliant, almost emulating that of the azure, gold, and silver rain, of the pyrotechnist:—

> "Beyond the shadow of the ship
> I watch'd the water-snakes:
> They moved in tracks of shining white;
> And when they rear'd, the elfish light
> Fell off in hoary flakes.

Within the shadow of the ship
I watch'd their rich attire;
Blue, glossy green, and velvet black
They coil'd and swam, and every track
Was a flash of golden fire."

In explanation of this phenomenon, Professor Jones observes that "a tumbler glass filled with the glowing wave, and set aside for accurate inspection, will be found to swarm with little points of translucent jelly, requiring close examination even to detect their presence, and yet so numerous that 30,000 of them have been calculated to be contained in a cubic foot of highly luminous sea-water." This little creature is the *Noctiluca miliaris.* Another animal, the *Lampyris Italica,* has been examined by Mr. Carus, who finds that when the shining unctuous matter is taken away from the body of the insect, and placed on a glass, and dried, it immediately loses its phosphorescence; but as soon as the glass with this matter is placed under a little water, its luminosity returns. In the *Lampyris Italica,* the light is not equal and tranquil, as in the *Lampyris noctiluca,* but is flashing; and in its periodicity answers exactly to the pulsations of the heart of the insect, since each wave of the blood, by moistening the luminiferous matter, gives it momentarily a more dazzling brilliancy.

The variety of colours which these microscopic myriads lend to vast expanse of water is very striking. The different colours of the Greenland sea-water—olive or bottle green, reddish brown, and mustard,—Dr. Scoresby, by the aid of the microscope, found to be owing to animalculæ of these various colours: in a single drop of mustard-coloured water have been counted 26,450 animals.

Kotzebue, the voyager, observed, when on the coast of

Brazil, a dark brown streak on the surface of the sea: it was about twelve feet wide, and extended in length as far as the eye could reach; it was found to consist of multitudes of minute crabs.

M. Lesson observed a vast expanse of red water off the coast of Lima; and another off California has been called "the Vermilion Sea." Sir Emerson Tennent describes as of a similar red hue the sea around Ceylon, which he ascertained to be owing to the presence of countless animalcules.

When Mr. Davison was on the coast of Chili, the vessel in which he was, passed through broad bands of reddish water, which, under the microscope, swarmed with animalcules, darting about, and often exploding: they swam by the aid of a ring of vibrating hairs, and were so minute that one thousand were not more than an inch in length. Dr. Pöeppig, in his *Voyage to Chili*, tell us that "from the topmast, the sea appeared, as far as the eye could reach, of a dark red colour, and this in a band, of six miles breadth. As we sailed slowly along, we found that the colour changed to brilliant purple, so that even the foam, which is seen at the stern of a ship under sail, was of a rose colour. The sight was very striking, because the purple streak was very distinct from the blue waters of the sea. The water, when taken up in a bucket, appeared quite transparent; but a faint tinge of purple was perceptible when a few drops were placed upon a piece of white porcelain, and moved rapidly backwards and forwards in the sunshine. A moderate magnifying glass showed that the little red dots consisted of *Infusoria*, of spherical form, entirely destitute of external organs of motion. We sailed (says the Doctor) for four hours, at the mean rate of six English miles an hour, through this streak, which was

seven miles broad, before we reached the end of it, and its full superficies must, therefore, have been 168 English square miles. If we add that these animals may have been equally distributed in the upper stratum of water, to the depth of six feet, we must confess that their numbers infinitely surpass the conception of the human understanding."

The ravages of minute marine animals are often to be witnessed in these sea *finds*. The drift-wood of the London clay is perforated both by an extinct species of the Ship-worm, and by an extinct form. The life of this secret agent, the cause of so many ships being

In the deep bosom of the ocean buried,

is very remarkable. In appearance it is a small white bulb of almost invisible matter, which, if placed on the point of a fine needle, under the microscope, shows the shipworm perfect in all its parts, and capable of cutting wood for its subsistence. Daily the animal grows like an oyster: it has neither arms, legs, nor fins, but is a gelatinous substance, its habitation only in wood, and as it grows, it manufactures a calcareous sheathing to the surface of the burrow. In summer it grows from 6 to 12 inches in length, and generally reaches $\frac{3}{8}$ of an inch in diameter; but in some places the worm is small as vermicelli threads in soup. As soon as it is brought forth, it commences its ravages: it has a head or bivalved auger, two parts working on a hinge, something like small pearl cups, with fine cutters (teeth) that appear under the microscope well adapted to destructive purposes were the substance a custard to pass through, instead of being, as it often is, a hard pine knot. There is no wood, bitter or sweet, except the cabbage-tree, that Mr. Jarvis, of

Washington, did not find the worm attack or enter; but it never bores through a ship's bottom plank, never passes through it to open space. Each worm keeps its own separate cell. "How strange it is," says Mr. Jarvis, "that these creatures will perforate the hardest wood: I often believe that they have a power, (perhaps a peculiar acid,) with which the hardest substances can be softened and perforated." *

* This was the commonly received opinion, but has been proved incorrect. The "boring habits" of these animals have been patiently watched and investigated. They were publicly exhibited at work in the Pavilion, at Brighton, in 1851, perforating chalk rocks by the rasping of their valves and the squirting of their syphons. Mr. Robertson, who exhibited these animals, received from an intelligent lady this evidence:—"She observed two animals, whose perforations were bringing them nearer and nearer to each other. Their mutual raspings were wearing away the thin partition which separated their crypts. She was curious to know what they would do when they met, and watched them closely: when the two perforating shell-fish met and found themselves in each other's way, the stronger just bored right through the weaker *pholas*." Stark, in his *Elements of Natural History*, however, in 1826, showed that the Pholades perforated the shale rocks in which they occur on the Scottish coast, by means of the rasping of their valves, and not by acids or other secretions. From also finding that their shells scratched limestone without injury to the fine rasping rugosities, he inferred it was by the same agency they perforated the hard limestone rocks. What then is the means by which the animals perforate? It was, at first, thought to be the gizzard; but Mr. Harper believed it to be a muscle solely for the purpose of aiding the animal's boring operations: "being situated in the centre of the foot, we can readily conceive the great increase of strength thus conveyed to the latter member, which is made to act as a powerful fulcrum, by the exercise of which the animal rotates,—and at the same time presses its shell against and rasps the surface of the rock." To prove this, Mr. Harper disentombed an animal, cut a slit in the base of its foot, and there found the boring implement to be an opal cylinder; and a piece of the bored rock shows the larger pholas to have bored through its smaller and weaker neighbour, the shell of the latter, most fortunately, remaining in its own cavity.

With the auger-formed head of the worm in view, the elder Brunel, in 1814, designed his cast-iron shield in forming the Thames Tunnel: as the perforation is made by the worm, the sides are secured and rendered impervious to water, by its lining the passage with a calcareous secretion; in like manner, the workmen in the Tunnel shield lined with brick-work the excavation as fast as it was made. The Shipworm has long been known in the harbours on our coasts, as the auger-worm and gribble.

Much in the same way that the shipworm works, the Siphunculi, frequently to be met with near low-water mark, inhabit holes which they excavate in the sand to a considerable depth, lining them through with a calcareous secretion, nearly in the manner that a well is lined with brick-work. In these retreats, (says Professor Jones,) they move up and down with great facility, coming to the surface when the tide is up, and displaying their flower-crowned proboscis; but withdrawing themselves rapidly when disturbed, into their holes, at the bottom of which they hold themselves firmly by means of their dilatable posterior extremity. In China, the Siphunculi are served at the table of the epicure; and the strange fishery is conducted as follows:—at low tide, the Chinese fishermen assemble on the shore in troops, each bringing with him a bundle of slender cane rods, each sharpened at one end, and having a little ball or button just above the sharp point. Arrived at the fishing-ground, the Chinaman drops one of these rods with its point downwards into every hole, and there leaves it. In a little time he returns, and, having previously removed the sand to a proper depth, gently draws forth the rod, to which, by this time, the animal has attached itself by swallowing the button.

The Siphunculi are thus procured in considerable quantities, and cooked either with garlic or with *garo sooy*.

Here we close our sketch of the Wonders of the Sea-shore, where, it is evident, will ever be found most abundant interest for the idler, as well as for a more intelligent class of visitors. It has been well said that "the simplest coral and the meanest insect may have something in its history worth knowing, and in some way profitable. Every organism is a character in which Divine wisdom is written;" and how to expound will result from the knowledge of *how to observe*. This has been greatly facilitated of late years by the Marine Vivarium, in the Garden of the Zoological Society, in the Regent's Park; or, in other words, a miniature sea, in which we may watch the habits of the creatures of the great deep at sufficient leisure to study their peculiarities. The success of this experiment was one of the beneficial consequences of the removal of the duty off glass; although the Minister may not have mentioned in his budget this special instance of benefit. Without such remission, the large glass ponds for the Vivarium could not have been made. The Aquarium has since become the amusement of many an intellectual household; and in the Jardin d'Acclimatisation at Paris, is an aquarium, stated to be the largest ever constructed—some forty yards in length, and ten in breadth. The study of the habits of marine creatures, by this domestication, is a most interesting pursuit; but to observe them at the sea-side, and to search for these living treasures among the rocks, and in the translucent wave, is a recreation which has Science for its handmaid,—

Guide, philosopher, and friend.

V.

A FEW MARVELS OF THE INSECT WORLD.

IN contemplating the Insect World, we are first struck with the infinite numbers of which it is composed. They are reckoned by millions and billions; and its name is Legion. Its myriads include the most prolific animal in existence. Such is the White Ant (*Termes fatalis*), which produces 86,400 eggs each day, and which, continuing for a lunar month, gives the astonishing number of 2,419,200, a number far exceeding that produced by any known animal.

When our wonder at the vast number of Insects has subsided, we are next struck with the enigmas and paradoxes they are continually presenting for our solution, and still more with the resemblance they bear to man in their capacities for love and labour. When, in 1856, M. Michelet retired to Switzerland, to recruit his health and spirits, one of his earliest recreations was drawn to the wonderful world of insects by witnessing a scene which vividly brought to his recollection the scene of turmoil from which he had just escaped, and impressed him with the strictness of the parallel between human and insect life. Seated one day at the foot of a fir-tree, meditating upon the destruction of an ant-hill he had just been witnessing, he thus eloquently reflected: "Accustomed as I had been to the downfall of

republics and empires, this scene plunged me into a sea of thoughts. What can I do, I asked myself, for this world destroyed, this city overthrown; what for this great insect nation, so laborious, so deserving, persecuted, devoured, and despised as it is by all the tribes of the animal world, whilst exhibiting the most striking images of disinterested affections and of devotion to the common weal; which is, moreover, endowed with the social sentiment in its most burning energy? One thing—endeavour to understand it; explain it if I can, and place it in a favourable light."

In pursuance of this resolution, the historian wrote his charming volume, *L'Insecte*. He became more and more impressed with the community of action and destiny subsisting between insects and ourselves, and which renders it impossible, M. Michelet considers, that we should look upon them otherwise than our relatives; while to see how completely Michelet is imbued with this sentiment, we have only to turn to a description he gives of a battle at which he assisted between an army of black and red ants. One of his critics well observes: "Whilst reading his graphic and eloquent account, it is, in fact, difficult to remember that it is but of a contest between insects that he is speaking, and not of a combat waged by human beings, mighty men of valour, the issue of which will decide the fate of a dynasty."

The parallel is carried still further by Kirby and Spence, in showing that "He who teacheth man knowledge has instructed insects to anticipate him in many useful arts and machines." "The builders of Babel," say our entomologists, "doubtless thought their invention of turning earth into artificial stone a very happy discovery; yet a bee had practised this art, using indeed, a different process on a smaller scale,

and the white ants on a large one, ever since the world began!" The history of insects tells us that many of them have "been architects from time immemorial, and that they have had their houses divided into various apartments, and containing staircases, gigantic arches, domes, colonnades, and the like; nay, that even tunnels are excavated by them, so immense, compared with their own size, as to be twelve times bigger than that projected by Mr. Dodd to be carried under the Thames at Gravesend! The modern lady who prides herself on the lustre and beauty of the scarlet hangings which adorn the stately walls of her drawing-room, or the carpets that cover its floor, is ignorant all the while that before she or her ancestors were in existence, and even before the boasted Tyrian dye was discovered, a little insect had known how to hang the walls of its cell with tapestry of a scarlet more brilliant than any of her rooms can exhibit; and that others daily weave silken carpets, both in tissue and texture, infinitely superior to those she so much admires. Other arts have also been equalled and forestalled by these creatures. What vast importance is attached to the invention of paper! For near six thousand years one of our commonest insects has known how to make and apply it to its purposes; and even pasteboard, superior in substance and polish to any we can produce, is manufactured by another. * * * * If we think with wonder of the populous cities which have employed the united labours of man for many ages to bring them to their full extent, what shall we say to the white ants, which require only a few months to build a metropolis capable of containing an infinitely greater number of inhabitants than even imperial Nineveh, Babylon, Rome, or Pekin, in all their glory?"

Reverting to the tunnel-boring operations just noticed, we may add that Mr. Bates, the Naturalist on the Amazons, witnessed the magnitude of the operations of which the Saüba ants are capable, and of which we can form an impression when we hear of their piercing embankments, and excavating a tunnel under the bed of the river Parahyba, at a place where it is as broad as the Thames at London Bridge.

Of the wonderful sight of Insects here is a well-authenticated proof. In each eye of the Dragon-fly have been counted, by aid of the microscope, 13,500 lenses, each of which may be considered as a distinct eye. M. Leuwenhoek having prepared the eye of a fly for the purpose, placed it somewhat further from his microscope than when he would examine an object, so as to leave a proper focal distance between it and the lens of his microscope. He then looked through both, in the manner of a telescope, at the steeple of a church, which was 299 feet high, and 750 feet distant, when he could plainly see through every little lens, the whole steeple inverted, though not larger than the point of a fine needle. Next, directing it to a neighbouring house, he saw through many of these little eyes, not only the front of the house, but also the doors and windows, and could perceive whether the windows were open or shut.

But the eye of the working Bee is a still more wonderful organ. It has three large eyes, and 3,500 smaller ones, or telescopes, small but perfect hexagonal lenses, fitting closely together, and disposed in regular rows over the whole circumference. One of these compound eyes may be compared to a bundle of telescopes (3,500 remember!) so grouped together, says Mr. Samuelson, in his admirable book on the Honey-bee, "that the large terminal lenses present an exten-

sive convex surface; whilst, in consequence of the decreasing diameter of the instruments, their narrow ends meet and form a smaller concentric curve. Now, if you can imagine it possible to look through all these telescopes at one glance, obtaining a similar effect to that of the stereoscope, you will be able to form some conception of what is probably the operation of vision in the Bee. The effect of this arrangement is, that if there should be any aberration or divergence of the rays of light during their passage through one portion of the lens, it is rectified in its transit through the other. Now it is nothing new to find in the eye of an animal lenses of different densities; but we do not recollect ever having heard of any other instance where one compound lens has been found consisting of two adherent ones of this description. How remarkable, then, that we should discover such a phenomenon in so humble an animal as the Bee! Ay, reader; and how remarkable, too, that we should find such a contrivance adopted by man in the construction of what he at present considers the most perfect microscopic lens!"

Yet, the little insect had used this lens for thousands of years, perhaps, before man trod the earth. By this apparatus of thousands of light collectors and reflectors, capable of forming a single picture by means of a great number of smaller images, when the Bee enters the hive, it economises every particle of straggling or darting light; and if we call to mind the many thousands of these illuminators, all in optical operation throughout the hive, how can the Bee be said to work in the dark!

Here we may observe that in no branch of Natural History do we find that such rapid progress has been made by means of the microscope as in the anatomy of the insect races.

John Hunter tells us that "a Dragon-fly has the largest eyes of any insect; it has a vast number of black spots, which move with our eye, as they do in the Grasshopper, but there is one principal one in the centre of the others." Hunter little dreamt that each of the "black spots" is the external lens of an eye far more perfect than he conceived the whole organ to be, and that (according to the computation of the most accurate observers) the Dragon-fly possesses 13,500 such *ocelli*, or little eyes!

Next to the faculties of Insects is their surprising strength. As the integument covering the insect is much harder than bone, so are the muscles stronger compared with those of the vertebrata. From the time of Socrates, have comparisons been made between the strength of the horse, and that of the insect; to the undoubted superiority of the insect. The common flea, it is well known, will, without much apparent effort, jump 200 times its own length. M. Delisle observed a fly, "so minute as almost to be invisible," which ran nearly six inches in a second, and in that space was calculated to have made one thousand and eighty steps. This, according to the calculation of Kirby and Spence, is as if a man, whose steps measure only two feet, should run at the incredible rate of twenty miles in a minute. Mr. Newport relates that the Stag Beetle, which tears off the bark from the roots and branches of trees, has been known to gnaw a hole an inch in diameter, through the side of an iron canister in which it was confined, and on which the marks of its jaws were distinctly visible, as proved by Mr. Stephens, who exhibited the canister at a meeting of the Entomological Society. The common Beetle can, without injury, support and even raise very great weights, and make its way beneath almost any amount of

pressure: it has been proved able to sustain and escape from beneath a load of from 20 to 30 ounces, a prodigious burthen, when it is remembered that the insect itself does not weigh as many grains; in fact, once more taking man as a standard of comparison, it is as though a person of ordinary size should raise and get from under a weight of between 40 and 50 tons. This amount of strength is not, however, confined to the short, thick-limbed beetles. Mr. Newport fastened one of the most active and elegantly-formed of the beetle tribe—which weighed only three grains and a half, by a fine silk thread to a piece of paper, upon which the weight to be moved was placed. At a distance of ten inches from its load, the insect was able to drag after it, up an inclined plane of 25 degrees, very nearly 85 grains; but when placed on a plane of 5 degrees inclination, it drew after it 125 grains, exclusive of the friction to be overcome in moving its load,—as though a man was to drag up a hill of similar inclination, a wagon weighing 2½ tons, having first taken the wheels off.*

The rate at which Insects move has been calculated by the sound-measuring instrument called the Sirene, which being brought into unison with the sound or harmony produced by winged insects, indicates, as in the case of any other musical sound, the rate of vibration. In this way it has been ascertained that the wings of a gnat flap at the rate of 15,000 times per second. The pitch of the note produced by this insect in the act of flying is, therefore, more than two octaves above the highest note of a seven-octave pianoforte. The wings of some insects are so thin, that 50,000 placed one upon the other would not form a heap of more than a quarter of an inch in height.

* Professor Rymer Jones's Natural History of Animals.

The tenacity of life in Insects is very great. Mr. Adam White, in 1851, exhibited to the Entomological Society, a Spider and a Crane Fly, brought from the Arctic Regions; and remarked that the eggs of these fragile creatures, being laid upon the ground, exposed for many months to the most intense cold, and still preserving their vitality, was a most surprising instance of the power of animal life. He stated his belief that the number of insects in the Polar Regions is much greater than is generally supposed, this opinion being founded on the observation of recent visitors to these inhospitable parts. Sir James Ross has frozen and thawed the same caterpillar several times without affecting its vitality.

The Light emitted from certain Insects has long been a special wonder with travellers. The author of *Six Months in the West Indies* took much pains to ascertain the true economy as well as the magical beauty of these glorious creatures, Fire Flies, which are described as atoms of green fire illuminating the woods upon the mountains as with ten thousand flaming torches—now rising, now falling, vanishing here, reappearing there, converging to a globe, and diverging in spangles.

There are two sorts: the small fly, which flits *in and out* in the air; and a kind of beetle, which keeps more to the woods, and is somewhat more stationary, like our glow-worm. This has two broad eyes in the back of its head, which, when the phosphorescent energy is not exerted, are of dull parchment hue; but upon the animal being touched, shoot forth two streams of green light, as intense as the purest gas. But the chief source of splendour is a cleft in the belly, through which the whole interior of the beetle appears like a red-hot furnace. The author says: "I put one of these natural lamps under a wine-glass, in my bed-room in Trinidad, and in order

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to verify some accounts which I have heard doubted, I ascertained the hour on my watch by its light alone with the utmost facility."

Phosphorescent Insects are numerous in Cuba; and a dozen of the large kind, called the Cocuyo, inclosed in a cage, will emit so much light, of a brilliant green colour, as to enable you to read by it. Mr. Turnbull tells us that the eccentric Mr. Joseph, of Trinidad, is stated to have written several volumes by this light! The insects may be preserved alive for three months, or more, provided they are frequently bathed; and their favourite food, a piece of sugar-cane stripped of its bark, is renewed, at least, daily. The Mexican ladies use these insects for ornamental purposes. The light has been described as proceeding from two small bodies on the insect's head, from under the abdomen, and between the corslet and the wings: it is probable that the substance susceptible of becoming luminous is spread all over the body. A century ago, when a few insects of this class were brought alive to Paris, in some old wood, their *light* caused great alarm, on its discovery. Now, its nature is better understood; and it has been ascertained when the shining unctuous matter is taken away from the body of the insect, and placed on glass, and dried, it immediately loses its phosphorescence; but, if placed under water, its luminosity returns. In some of these insects the light is not equal and tranquil, but flashes at intervals, according to the pulsations of the heart of the insect, each of which gives the luminiferous matter a more dazzling brilliancy. This property was known to some of the old naturalists: Bomare, who wrote three hundred years ago, tells of the Utica, a species of rabbit, in the West Indies, which was hunted at night by the light of a luminous insect.

Insects have many enemies, and among them, plants, which imprison the little creatures in a trap. Mr. Leonard Knapp, in his charming *Journal of a Naturalist*, describes these imprisoning plants, and accompanies the details with admirable philosophy. "It is," he says, "a perplexing matter to reconcile our feelings to the rigour, and our reason to the necessity, of some plants being made the instruments of destruction to the insect world. Of British plants we have only a few so constructed, which, having clammy joints and calyxes, entangle them to death. The sun dew (droseræ) destroys in a different manner, yet kills them without torture. But we have one plant in our gardens, a native of North America, than which none can be more cruelly destructive of animal life, the poisonous dogsbane, (apocynum,) which is generally conducive to the death of every fly that settles upon it. Allured by the honey on the nectary of the expanded blossom, the instant the trunk is protruded to feed on it, the filaments close; and, catching the fly by the extremity of its proboscis, detain the poor prisoner, writhing in protracted struggles, till released by death,—a death apparently occasioned by exhaustion alone; the filaments then relax, and the body falls to the ground. The plant will at times be dusky from the numbers of imprisoned wretches.

"This elastic action of the filaments may be conducive to fertilizing the seed, by scattering the pollen from the anthers, as is the case with the berberry; but we are not sensible that the destruction of the creatures which excite the action is in any way essential to the wants or perfection of the plant; and our ignorance favours the idea of a wanton cruelty in the herb; but how little of the causes and motives of action of created things do we know! and it must be unlimited

arrogance alone that could question the wisdom of the mechanism of Him 'that judgeth rightly;' the operations of a simple plant confound and humble us, and, like the handwriting on the wall, though seen by many, can be explained but by ONE."

By the train of thought into which we are led by the above reflections, and the conviction that

> Just are the ways of God,
> And justifiable to men,

we are reminded of the remarkable injuries inflicted upon other animals by a very small insect. Dr. Livingston, in his *Missionary Travels and Researches*, tells us, that "By far the most important animal in South Africa is a little fly called the Tsetse, which determines the fortunes and habits of thousands of men. It is not much larger than the common house-fly, and is nearly of the same brown colour as the honey-bee. Its bite is certain death to the ox, the horse, and the dog; but it is entirely harmless to man, mules, asses, goats, swine, all wild animals, and even calves as long as they suck the cows. When an ox is bitten, there is no immediate effect, but a few days afterwards emaciation commences, and the animal pines away. The poison operates on the blood, and is injected through the proboscis, not by a sting. Fortunately, the Tsetse is local, and although found in one valley, may never come near the next. But as there is no remedy known, and a very few flies will destroy a whole herd of oxen, there are many tribes that abandon any attempt to keep oxen or horses, and between contiguous tribes the possession of the localities free from Tsetse is a constant object of jealousy and dispute."

Another recent traveller, Mr. Bates, describes as one of the plagues on the Amazons, the Pium, a minute fly, which fastens on the human skin with the most blood-thirsty propensity. This is a terrible scourge along the Upper River, or Solimoens, to the end of the navigation on the Amazons, where it relieves the musquito at sunrise, coming forth in such dense swarms as to resemble thin clouds of smoke. These little pests make in the skin punctures which blacken it with their endless numbers, and leave it in a highly irritable state; but the insect is not found in the shade of the forest, nor in certain reaches of the navigation. Besides the Pium, there is found on the Upper Amazons a species of æstrus or gadfly, which fixes on the flesh of man as a breeding-place for its grubs: the result is a painful boil with an animal inside it an inch in length, and of increasing breadth from head to tail, besides being secured to the flesh of the inside of the tumour by two horny hooks. Happily this gadfly can be dislodged by a little tobacco-juice, to which he entertains a most convenient repugnance. There is another bloodthirsty fly, the Motúca, which fastens on the traveller whenever he lands on the Upper Amazon, in the neighbourhood of a sand-bank; but this fly is sure to be followed by a certain wasp, the Monedula signata, who attacks the fly attached to your skin, and carries him off with the adroitness of an accomplished vermin-killer.

Stories of Ants, their ravages, and manœuvres, their vast numbers, and their order and method in whatever they undertake, read like so many records of human history; and in both cases are alike exemplified the couplet:

> Order is Heaven's first law; and this confess'd,
> Some are, and must be, greater than the rest.

With many of these Ant-tales the reader is, doubtless, familiar. Mr. Bates found in the forests of Brazil the Saüba Ant, named at page 96, which in its numbers and activity, equals any of its kindred, and evinces some instincts which are as novel as they are ingenious. Everywhere in the neighbourhood of Para, Mr. Bates tells us, the Saüba Ant is seen marching to and fro in broad columns, and carrying destruction among the cultivated trees and vegetables of the Brazilians. So large are the communities of this little creature that the traveller often comes upon heaps of their dwellings, of not less than forty yards in circumference, though not more than two feet in height. These are domes which overlie and protect the entrance to vast subterranean galleries, which lie at a considerable depth. Now, we have read of Ants clipping and carrying away circular pieces of leaves; and, in this instance, Mr. Bates found many piles of these leaves lying on the pathway, unattended by Ants, but they were invariably removed when revisited the next day. He had frequent opportunities of seeing the Saüba Ants at work, clipping and preparing the leaves from the neighbouring trees; and after much patient watching, he found that with the leaves thus prepared, the Ants *thatched* the entrance domes we have spoken of, and by this means protected from deluging rains the young brood in their nests beneath.

The Brazilian gardeners are sworn foes to these destructive Ants, but the demolition of their nests is no slight business: such is their extent that Mr. Bates saw a gardener at Para attempt to destroy one of these underground colonies by blowing in the fumes of sulphur, when the smoke issued from other outlets at seventy yards' distance from the place where the fumigating bellows was used. The Saüba evinces

what appears to be a want of foresight which does not accord with their general habits. In their nests the Amphisbœna Snake habitually takes up its abode, coming out occasionally in the night-time; and from the remains of the Saüba Ants being found in the Snake's stomach, they seem literally to board upon as well as lodge with their Saüba landlord. The natives call the Amphisbœna "the Mother of the Saübas," and say that the Ants treat it with great affection, and that if the Snake be taken away from a nest, the Saübas will soon forsake the spot: this Mr. Bates regards as mythical: still, the relations between the Ants and the Snakes does not accord with the general position of landlord and tenant. Another species of winged Ants Mr. Bates saw in such myriads blown into the river by a sudden squall, that they were heaped up in a line for miles at the edge of the water. Other Ants are so fierce, that the natives, when they meet them, fly from them, so serious are their attacks. Of another species Mr. Bates witnessed manœuvres in campaign, on the line of march, and even attacking ant-citadels.

Mrs. Carmichael also relates a similar service of Ants to Serpents. The *parasol ants* of Trinidad, in the West Indies, walk in long procession, each carrying a cut leaf over its head, as a parasol, in the sun, and these they deposit in holes 10 or 12 feet under ground, apparently with no other object than to form a comfortable nest for a species of white snake which is invariably found coiled up among them on digging out the deposit.

According to the observations of Dr. Horsfield, in Jena, and probably in most parts of India, the Ants are the universal destroyers and removers of all useless or decayed matter, whether vegetable or animal. This is precisely the

case both in tropical Africa and America, and at once accounts for the scarcity of those families of Beetles which are appointed to perform such offices in more temperate regions.

M. du Chaillu, in his explorations in equatorial Africa, describes the Bastrikouay Ant, the scavenger of the country, to be so voracious and so strong that man and beast, bird and insect, of every size, of any strength, alive or dead, fall certain victims to their power. As they march through the country in a vast army, literally numbering billions of individuals, the tallest tree-top is no refuge from their attacks, if that tree stands in their path; but step a little out of their way, and you are safe.

The ravages of White Ants continue to be as destructive as when Smeathman wrote about them near a century since, although we are more familiar with their wonders. In the island of St. Helena, the White Ants were, it is supposed, accidentally introduced from the coast of Guinea, about twenty years since; and only last year, almost every dwelling, store, or shed, in Jamestown, the capital of St. Helena, and containing nearly 4,000 inhabitants, were seriously injured by the White Ants, involving in many instances complete ruin and abandonment, and imperilling the lives of large numbers of the poorer classes by the insecurity of their houses. The Governor of St. Helena applied to the Lords of the Admiralty for information as to the best mode of finding the Ants' nests, and effectually destroying them; also, as to the description of timber which has proved to be the least susceptible of injury from the insect. These inquiries were referred to the Entomological Society, when Gen. Hearsey, from his own experiences in connexion with the White Ants of India, said that the nests must be sought in the plain;

that if once they effected a lodgment in the walls of a house the walls themselves must be taken down before the insects could be got rid of. He thought the best preventive of their attacks was to steep the timber before building in a solution of quicklime; whilst store-boxes, furniture, and small articles, should be brushed over with a solution of corrosive sublimate. Creosote has also been found a preservative of timber impregnated with it, or rather forced into it by hydraulic pressure.

Mr. Bates tells us that the houses on the banks of the Amazons are not much infested with White Ants, which he attributes to the use of very hard wood, Acapu, in building; store-boxes, if placed on sleepers, or cylindrical pieces of this wood, are mostly protected. When the Ants have got into the walls, (which, in the Amazon country, are principally composed of upright posts, with cross laths, filled up with mud, and covered with lime, or cement,) the holes in the walls should be filled with arsenical soap, and washed over with a solution of it, with which also boxes may be washed over. Thus, as regards prevention and remedy, we are much in advance of the chemical appliances of the last century to ward off the ravages of this very prolific destroyer.

M. Michelet, in his *L'Insecte*, is strongly interested in the Ant. In him the principle of fraternity is strongly implanted; and M. Michelet mentions that M. Latreille once saw an Ant dress the wound of a brother, one of whose antennæ had been amputated, by spreading upon the injured part a covering of honey to preserve it from contact with the air. In his study of the Ant, Michelet saw that everything that had heretofore appeared paradoxical and incredible about this insect he found to be inferior to the reality when he had an opportunity of verifying it. The following fact which he

states respecting it, had not, he thinks, been noticed before. His brother-in-law, M. Milaret, on one occasion, scattered among a colony of Ants a number of grains of wheat, barley, oats, &c. On opening the ant-hill afterwards he found the grains carefully sorted, and distributed into different store-chambers. No wonder that evidence of such intelligence should make M. Michelet feel it to be more and more difficult to treat as a *thing* such a wonderful *being*, one, who, like ourselves, wills, and works, and lives.

The economy of the Bee—"the little busy Bee"—of our childhood, is, throughout, a series of marvels. Its wonderful organ of sight we have already illustrated. Its sting is not, as might appear to the naked eye, a mere lance or bayonet, but is seen when magnified, to be a formidable barbed spear, furnished with suitable muscles, by which it is forcibly protruded from the sheath, when required for attack or defence, the weapon being generally left in the wound, with the little sack of poison attached to it. Our own experience tells us what a formidable weapon the sting must be when directed by the Bee against an insect of its own size.

In the Hive is a complete community of Bees: there is the Queen, the monarch and mother, a perfectly developed female; there are from 600 to 800 drones, or males; and workers, or partially developed females, to the number of from 15,000 to 30,000. The office of the Queen Bee is to lay all the eggs that are hatched in the hive, and she does nothing but add to its numbers: yet, she is the constitutional head of all, and should she be accidentally or designedly removed, one of the royal family, on the way from larvahood, is raised to the throne. If there be no Bee of the blood, the constitutional Bees proceed, by a wonderful instinct, and a remark-

able artificial contrivance, to force a fresh head for the apiarian state. They take from its cell an unhatched worker-egg, or a larva not more than three days old, and so alter the conditions of its early existence, as to convert it into a queen. They first enlarge the worker-cell, by destroying the surrounding cells, and slaughtering the inmates; and then, by the union of horizontal cells, previously destroyed, they form a singular vertical cradle, in which the heiress apparent is rocked. They feed her with royal paste, and treat her as the heiress to the throne, to which she ascends in due time. This is the most astonishing phase in the history of the hive, but it is avouched by reliable observers.

Should two young queens make their exit from their respective cells simultaneously, their fortune is decided by single combat, the people or Bees looking on. The rival sovereigns advance, fall upon each other furiously; seize each other with their jaws by the neck, head, and legs; butt heads together, grasp firmly with their legs, draw swords or stings, and thrust at the vulnerable body-rings, the neck, or between the chest and the abdomen; till the fatal thrust is given, and the pierced one staggers, falls, and dies.

The construction of the Cell of the Bee in the hexagonal form, the strongest and most convenient, is a wonderful fact; and, what is equally remarkable, the middle of every cell on one side, is directly opposite to the point where the three partitions meet on the opposite side; by which position the cell receives additional strength. It likewise requires the least expenditure of material and labour; and mathematicians have found, by the most exact mensuration, the precise angle at which the three planes which compose it ought to meet, in the very angle in which the three planes in the

bottom of the cell of a honeycomb do exactly meet. Kœnig, the Mathematician, then made a calculation to obtain the greatest strength with any given amount of materials, which he found different from the amount used by the Bee; but Lord Brougham has discovered that the Bee is right, and that the mathematician was wrong; and that other mathematicians with whom he has communicated agree with him, and have detected the same source of the error.

It is curious to find that the hexagonal form is not always strictly followed by the Bee. The wax cells of the Meliponæ, which Mr. Bates found on the banks of the Amazons, are generally oblong, showing only an approximation to the hexagonal shape in places where several of them are built in contact. Many are the varieties of Bees, of which, in general, it is remarkable that none of them have attained that high degree of architectural skill in the construction of their comb, which is shown in the European hive. It would appear, says Mr. Bates, that the Old World has produced in Bees, as well as in other families of animals, far more advanced forms than the tropics of the New World.

In all ages, philosphers have devoted much time to the habits of Bees; from Aristomachus, of Soli, in Cilicia, who, we are told by Pliny, for fifty-eight years, attended solely to Bees; and Philiscus, the Thracian, who spent his whole time in forests, investigating the habits of Bees,—to Swammerdam, Reaumur, Hunter, and Huber in modern times. Hunter was the first to discover that Bees do not collect wax, but secrete it: he says, "The wax is formed by the Bees themselves; it may be called an external secretion of oil, and I have found that it is formed between each scale of the under side of the belly."

There is more order and ingenuity among wasps than is commonly supposed. They place sentinels at the entrances of their nest, to give an alarm in case of danger. If these guards are seized and destroyed, the rest do not attack. Mr. Knight observed that if a nest of wasps be approached without alarming the inhabitants, and all communication be suddenly cut off between those out of the nest, and those within it, no provocation will induce the former to defend it and themselves. But if one escapes from within, it comes out angrily, as if commissioned to avenge the wrong, and will sacrifice its life in defence of the community.

To complete the antagonism of the Wasp and the Bee, and

> make
> Assurance double sure,
> And take a bond of fate,

the Wasp almost invariably builds its nest beside the nest of a wild Bee: in about 90 per cent. of nests Mr. Edgeworth found this to be the case.

But the most redeeming point in the character of the Wasp is its ingenuity. It builds its nest underground: the cells are hexagonal, like those of bees; the house is built of paper, fabricated by the insect; with powerful jaws it tears off decayed wood, which it moistens with a sort of gum or glue, secreted by itself, and this is formed into pulp, and spread out into thin sheets, to roof and surround the cells. Wasps seem to understand the laws of heat, and that atmospheric air is a good non-conductor: accordingly, they surround themselves with several walls of paper, leaving spaces between, and thus not only keep out the cold, but render the entrance of damp all but impossible. The combs of the Wasps are built in horizontal tiers; so that they are

builders as well as paper-makers. They are also admirable sappers and miners: they tunnel a covered way from their nest to the open air, and very often, instead of using a deserted mole or mouse hole, they excavate a round chamber of really fine proportions.

In the Zoological Society's Museum is a Wasp's nest from Ceylon, built inside a great palm-leaf, and not less than 6 feet in length. But a still more remarkable nest is preserved in the Ashmolean collection at Oxford. It was taken out of the ground at Cokethorpe Park, in the neighbourhood, in July, 1857, by Mr. Stone, of Brighthampton, who has made the habits of the Wasp his study. This nest was six inches in diameter, and was hung up in the window of an old house by a wire a foot in length. The Wasps having no confidence in this support, ran up, from the the top of the nest a column three inches in diameter, evidently with the intention of strengthening their position. This column was broken away two or three times, but was as often rebuilt by the Wasps; when, to prevent them doing so any more, the wire was greased. Thus thwarted, in losing their support from above, the Wasps formed a column, of about the same size and length, downwards, to support the nest from the window-sill; but this being broken off, the wasps gave up the point, contented themselves with the wire, and went on enlarging the nest in the ordinary way. Its gigantic size was owing to their being constantly supplied with a mixture of sugar and beer, their daily consumption during the height of the season being a pound of sugar and a pint of beer. Still, this was not the only cause. Two other nests of Wasps had been placed in a room on the first floor, but the Wasps finding themselves not so well treated with reference to rations, &c.

as their more fortunate neighbours on the groundfloor, began to desert in vast numbers, joined the favourite community below, and were well received. Thus the nest was extended to the height of 27¾ inches, and the circumference of 63 inches. Mr. Stone, the captor of this nest, possesses at Brighthampton, a series of six Wasps' nests, built in cubical boxes, and of most singular shapes; one resembles a stalactite cavern, and another the mysterious Stonehenge; the whole were built by a colony of Wasps in thirty-eight days, in the autumn of 1862.

Reaumur has stated the average number of Wasps in a nest to be 30,000; but Mr. Edgworth considers 2,800 as the maximum. The situation of the nest is said to be characteristic of the species. The nests of the common Wasp are generally formed on dry banks, in the roots of decayed trees, and occasionally in the thatch of cottages, but may occur almost everywhere. A nest was once found in a loaf of sugar, the shell being partly composed of the surrounding thin paper. Wasps generally chose a sloping place to build in, so that the earth they have been mining may easily roll out of the whole; and at the entrance of their nest a quantity of loose earth is generally to be seen, as if a mouse had been burrowing. Mr. Edgworth is, evidently, the Wasps' Defender: he denies the charge of their killing their young at the first cold of winter, though he thinks the grubs may be killed by early frost. He asserts that the love which Wasps display both for their young and for the place of their birth is very remarkable: he has seen them linger for upwards of twenty days' around some fragment of their cells, when the nest itself had been carried away; and Wasps soon become familiarised with any animal, or with man.

Wasps are omnivorous: early in the year, whilst they are still rapacious, their diet is almost exclusively animal; in the later months, vegetable fare seems more grateful to their effeminate nature. The reader will remember their fondness for bees; they also devour raw meat, fish, sweet things of every sort, flies, butterflies, spiders; and they have been known to kill even dragon flies, and to carry off the grubs from an ants' nest which had been disturbed. Their fondness for fruit is well known; and all persons that value their lives should, especially in seasons when Wasps are numerous, examine well every apple, pear, and peach they eat, for these venomous insects may often be seen ensconced under the skin; if admitted within the mouth, they will sting the throat, and in many cases, the sufferers will die.

Wasps are desperate enemies to bees, and the autumn of 1864 was marked by fierce and multitudinous bands of Wasps descending on bees on predatory incursions: indeed, Beemasters tell us there had not been for fifteen years such hosts of Wasps as in the above-named season. Their rushing into beehives has been compared to the attack of burglars; and a beemaster watched a conflict of this kind through a glass hive the Wasp entered: one bee, half his size, seized him by the throat, another gave him a taste of his sting, and two or three watchers seized him by the legs, and dragged him out. A Beemaster placed at the entrance of the hive a little piece of barley-sugar; out came a dozen bees, to feed on it, and thus was secured an additional guard at the gates; the moment the Wasp alighted, the whole *posse* flew at him, and drove him away. Another plan is to fill half-full a wine-bottle with beer and sugar: incidentally, a bee may look in, but the Wasps, whose scent is perfect, rush in and are

drowned. Our Beemaster indignantly exclaims:—"It is a sacred duty devolving on every Beemaster to exterminate these Arabs, Bedouins, and corsairs. They lay up no stores for themselves, they do nothing for the support or enjoyment of man. They use their stings, not like bees, in self-defence, but in sheer wickedness. They are professional thieves. They have no respect for *tuum*, and having no *meum* they care nothing for it. Living at the expense of others, without consulting the convenience or goodwill of anybody, they richly deserve what their extermination will pay for—sulphur, gunpowder, and boiling water. Let every Beemaster give 6*d.* to every boy who destroys a Wasp's nest. I am satisfied that killing Wasps is no murder. Had Peter the Hermit or Walter the Penniless lived in my garden, and witnessed these wicked vagabonds trying every hive, worrying my bees and stealing my honey, they would have preached a crusade against Wasps. In one respect they are unfortunate: they have no queen, no subordination, or reverence for law and order. They are genuine Red Republicans—Marats and Robespierres, and richly deserve the worst they get."

Such sanguinary advice was followed, to a very considerable extent, a few years since, in Kent, when Sir J. Lubbock, of High Elms Down, commissioned the North End schoolmaster to give a penny for every Wasp that was brought to him. He soon had taken 1,600 Wasps, exclusive of those caught by various persons about Sir John's estate. As every Wasp destroyed was a nest destroyed at that period of the year, and allowing one in five to be male, there were no less than 12,800 nests destroyed; allowing them to produce on an average 1000 young, there would be 1,280,000 young destroyed, which, with the parent Wasps, made 1,281,600,

the total number of which High Elms had thus been freed. Supposing, which is within compass, that every half-dozen Wasps destroy two apples, two plums, one peach, and one pear, that would make the fruit saved from destruction to be—Apples, 427,200; plums, 427,200; peaches, 213,600; pears, 213,600. Reckoning the apples at 10 a penny; plums, 24 ditto; peaches, 2 ditto; pears, 12 ditto; we have the money saved thus: in apples, 178*l.*; in plums, 74*l.* 3*s.* 4*d.*; in peaches, 445*l.*; in pears, 74*l.* 3*s.* 4*d.*: total, 771*l.* 6*s.* 8*d.*

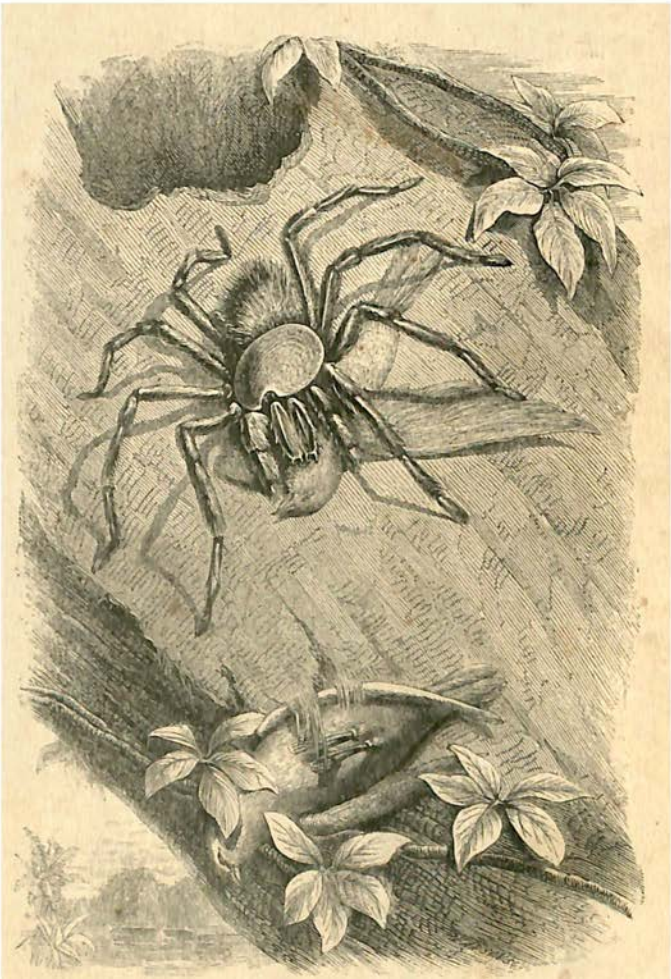
The Spider, at once so familiar and distasteful to every one of us, has been taken up by M. Michelet, who has so described its manner of life, its loves and hates, its character and disposition, as to make us henceforth regard the animal with feelings of interest and pity, if not admiration. "The worst thing about this poor animal," observes M. Michelet, "is that it is so thoroughly ugly. In it nature has sacrificed everything to the formation of the industrial machine necessary for satisfying its wants. Of a circular form, furnished with eight legs and eight vigilant eyes, it astonishes (and disgusts) us by the pre-eminence of an enormous abdomen, its workshop, its magazine, the pocket in which the rope-maker keeps his stock."... Michelet maintains that the Spider's watchfulness and cunning, timidity, uneasiness and nervousness—for it is more sensitive than any other insect—are the result of its miserable condition, which is a state of constant, passive, weary waiting. The fatal question, "Shall I get any dinner?" is continually presenting itself to the dweller in the web, followed by the still more sinister reflection, "If I have no dinner to-day, then no more thread, and still less hope of dining to-morrow." Of the faculty of the Spider, in the architecture of its web, we have evidence of practical value:

it was recently remarked in a professional periodical, the *Builder*, that a Spider's web furnishes a better plan for the laying out of new cities than any which has yet been devised by surveyors and engineers. Any one who can find a distinct and complete web unbroken will see how beautifully regular it is, and how perfectly adapted for the quickest passage from any one point to another. The concentric rings are not circles, but polygons, and the radiating is exquisitely regular and straight.

Among Michelet's terrible idylls, the "noir amours," as he calls them, of our ceilings, we find that the male Spider often makes a meal of his progeny, whilst the female loves them so tenderly that if she cannot save them in circumstances of peril she prefers to perish with them. The love which she bears to her little ones she does not extend towards her mate: sometimes, after having in vain attempted to prevent him from devouring their offspring, the idea appears suddenly to present itself to her mind that the cannibal is himself good for food, on which she instantly falls upon him and eats him up. Our home Spiders are of dwarfish interest. It is true that we had, many years ago, a large Spider, called the Cardinal, from his full-blown size, and named from his being found in the "Hall called Wolsey's," in Hampton Court Palace. But, what were these creatures to those entomological elephants, the Spiders of Ceylon, one species of which weaves the reeds or cords rather, as they are called, athwart the pathways, which more than once actually lifted Sir Emerson Tennent's hat off in riding; and when they strike the face, produce a painful twinge across that tender part. There is also a Ceylonese Spider, with legs which would span an ordinarily-sized

breakfast-plate; and it seems to be a fact, now pretty well authenticated, that these truculent fellows seize small birds, and feast upon their blood! It is known that there are such spiders both in Australia and in Hindostan, whose webs are strong enough to entangle and hold the small birds, on which they are said occasionally to feed; small house-lizards are also seized and devoured by these Spiders.

Mr. Bates, in a walk in the neighbourhood of Cameta, in Pará—noted for its "Brazil nuts"—chanced to verify a fact relating to the habits of a large hairy spider of the genus Mygale, in a manner worth recording. It was the Bird-killing Spider, or one very closely allied to it: the individual was nearly two inches in length of body, but the legs expanded seven inches, and the entire body and legs were covered with coarse grey and reddish hairs. Mr. Bates tells us that he was attracted by a movement of the monster on a tree-trunk: it was close beneath a deep crevice in the tree, across which was stretched a dense white web. The lower part of the web was broken, and two small birds, finches, were entangled in the pieces. One of these was quite dead, the other lay under the body of the spider, not quite dead, and was smeared with the filthy liquor or saliva exuded by the monster. Mr. Bates drove away the spider, and took the birds, but the second one soon died. "The fact of species of Mygale sallying forth at night, mounting trees, and sucking the eggs and young of humming-birds, has been recorded long ago by Madame Merian and Palisot de Beauvois; but in the absence of any confirmation it has come to be discredited. From the way the fact has been related, it would appear that it had been merely derived from the report of the natives, and had not been witnessed



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THE BIRD-KILLING SPIDER OF BRAZIL.

(*Copied, by permission, from "The Naturalist; or, The River Amazon."*)

by the narrators. Count Langsdorff, in his *Expedition into the Interior of Brazil*, states that he totally disbelieved the story." Mr. Bates found the circumstances to be quite a novelty to the inhabitants hereabout. The Mygales are quite common insects: some species make their cells under stones, others form artistical tunnels in the earth, and some build their dens in the thatch of houses. The natives call them crab-spiders. The hairs with which they are clothed come off when touched, and cause a peculiar and almost maddening irritation; the first specimen that Mr. Bates killed and prepared was handled incautiously, and he suffered terribly for three days afterwards, not, he thinks, owing to any poisonous quality residing in the hairs, but to their being short and hard, and thus getting into the fine creases of the skin. Some Mygales are of immense size: one day, Mr. Bates saw the children belonging to an Indian family with one of these huge spiders secured by a cord round the waist, by which they were leading it about the house as they would a dog. We quote these details from Mr. Bates's Adventures, and engrave one of the admirable Illustrations of the work.* The existence of any Bird-killing Spider was disbelieved by Mr. MacLeay, when he read a paper to the Zoological Society, upon the subject; but Mr. Bates's evidence establishes the fact of the Spider killing if not devouring the Bird. He adds that the number of Spiders ornamented with showy colours is somewhat remarkable. Some double themselves up at the base of leaf-stalks, so as to resemble flower-buds, and thus deceive the insects on which they prey.

* The Naturalist on the River Amazons. The illustration is copied by permission of the publisher, Mr. Murray, Albemarle Street.

In Corfu are some curious "Trap-door Spiders," which have a strange constructive faculty. This Spider excavates for himself in a sloping bank, a circular hole, about three inches in depth by one-third in diameter; this he lines with a silky web, and at the mouth of the hole he fixes a circular door with a hinge, composed of clay moistened with the glutinous substance of which the web is composed. This door he always shuts after going in or out; as soon as he finds a stranger at his door, he secures it on the inside, possibly by holding it down with his claws, which are very powerful: and it is necessary to use some force to open the door. This narrative, in which the Spider plays the part of a carpenter and a potter, was attentively heard at the meeting of the British Association, at Bath, in 1864.

Spiders very properly belong to the *Arachnida*, named from Arachne, the Lydian woman, who excelled in weaving, and challenged Minerva to a contest, and having been surpassed, hanged herself; when the goddess, in commiseration of her unhappy fate, turned her into a spider.

Spiders have been brought to spin silk, though their natural fierceness rendered them unfit to be bred and kept together; two hundred of them would not produce more silk than one silkworm; and 663,555 such Spiders would scarcely yield a pound of silk!

Although Spiders are not provided with wings, and, consequently, are incapable of flying in the strict sense of the word, yet, by the aid of their silken filaments, certain spiders are enabled to accomplish distant journeys through the atmosphere. These aerial excursions, which appear to result from an instinctive desire to migrate, are undertaken when the weather is bright and serene, particularly in the autumn,

both by adult and immature individuals, and are effected in the following manner. After climbing to the summits of different objects, they raise themselves still higher by straightening the limbs; they then elevate almost perpendicularly the abdomen with four spinners, each of which is pierced, like the plate of a wire-drawer, with holes so fine that a pin's point space includes a thousand; and from these spinners the Spiders emit a small quantity of viscid fluid, which is drawn out into fine lines by the ascending current of air. Against these lines this same current strikes, till the animals, feeling themselves acted upon with sufficient force, quit their hold of the objects on which they stand, and mount aloft. The manner in which the lines are carried out from a current of air appears to be this. Through each of the holes of the four spinners proceeds a thread, which immediately unites all the other threads from the same spinner into one. Hence, from each spinner proceeds a compound thread; and these four threads again unite, and form the thread we are accustomed to see, which the Spider uses in forming its web, and which is not a single line, but a rope composed of at least four thousand strands, which may be drawn out to a length regulated by the will of the animal. It is, however, doubted whether the Spider has the power of propelling these fine lines amid the rapid fluctuations of the atmosphere; and it is believed that they accordingly spin in the direction of the breeze, the line becoming connected with some object in the vicinity, and affording the Spiders the means of regaining their liberty.

Medicinal virtues have been attributed to the Spider's Web. It is noticed in old dispensatories as a remedy for ague and fever. To the bodies and to the eggs of the Spiders,

in a scarce Latin work more than two centuries old, is attributed the property of dispersing white specks in the eye. The cobweb applied to a bleeding surface occasions a very sharp and transient pain, and the bleeding ceases instantly. The cobweb should be the produce of the black spider, which inhabits cellars, barns, and stables; that which is found upon hedges in autumn does not possess the same power, if it be actually of the same nature.

HUNTING THE TARANTULA SPIDER.

This celebrated Spider will be remembered in old wonder-books of magical cures, as an instance of the bite of a poisonous spider being charmed away by music; certain songs and tunes being solemnly used for the occasion, and the Tarantula itself dancing to the air of the Tarantella. Thus much is certain—that a venomous spider exists in the south of Italy, the bite of which produces disorders of the nervous system, with violent convulsive movements. This has been exaggerated by the force of imagination and the instinct of imitation, into *a dance*. The cure *by music* is not of such easy explanation; unless we are to consider that music may have soothed some sufferer in racking pain, and so the Spider may have syllogistically given name to the air, and thus have added another marvel to the oft-quoted—

> Music hath charms to soothe the savage breast,
> To soften rocks, or bend a knotted oak.

Beyond this fabulous celebrity, the economy of the Tarantula has a better established fame of a more entertaining character.

M. Leon Dufour set himself to watch the habits of this curious creature, which inhabits, from preference, exposed places; dry, barren, uncultivated, and open to the sun. He hides himself, generally, at least when full grown, in underground passages, complete burrows, which he digs for himself. These burrows, though noticed by many authors, have been imperfectly studied. They are cylindrical, often one inch in diameter, and sunk more than one foot in the ground. They are not simply perpendicular. The Spider proves that he is, at the same time, a skilful hunter and an able engineer. It is necessary not only that he should form a deep intrenchment which might hide him from the pursuit of his enemies, but also establish there a place of observation, from which he may spy out his prey, and dart like an arrow upon it. The Tarantula foresees all this. The subterranean passage first takes a vertical direction; but, at four or five inches from the surface, it turns in an obtuse angle, forms a horizontal bend, and then re-assumes the perpendicular. At the commencement of this bend, the Tarantula, as a vigilant sentinel, never, for a moment, loses sight of the door of his dwelling; and here M. Leon Dufour perceived the creature's eyes, glittering, like diamonds, and rendered bright, like those of a cat, by darkness. Externally, the opening of the Tarantula's burrow is surmounted by a sort of funnel, of the creature's own construction, and which authors have overlooked. This funnel, which M. Leon Dufour describes as a true piece of architecture, rises about an inch above the surface of the ground, and is sometimes two inches in diameter; so that it is larger than the burrow itself.

This last circumstance, which looks like forethought in the industrious spider, is of wonderful use in affording room for

the necessary extension of his legs, at the moment he is about to seize his prey. The funnel is principally composed of fragments of dry wood united by a little clay, and disposed one upon another, with such constructive skill, that they form a scaffolding in the shape of an upright column, which is hollow. This tubular structure, or advanced bastion, is lined or tapestried within by a tissue spun and woven by the Tarantula, and continued throughout the whole interior. It is easy to conceive how useful this skilfully fabricated drapery must be, in preventing the crumbling in of the earth, or any such accident to the structure as well as its assistance, to the Tarantula in scaling his fortress.

But this outer fortification of the burrow does not always exist: indeed, the holes of Tarantulas are often met with where no traces of it can be seen. Possibly, in such cases, the outwork may have been accidentally destroyed by unfavourable weather; or the Tarantula may not always find materials for its construction; or, says M. Leon Dufour, "perhaps the talent for architecture only declares itself in individuals arrived at the last stage of physical and intellectual development. Nevertheless, it is very certain that I have had numerous opportunities of proving the existence of these funnels, these outworks of the Tarantula's abode. This Spider has many purposes to answer in its construction. It not only protects its intrenchment from inundations, and fortifies it against the falling of external bodies, which, swept by the winds, would be likely to close it up—but it also serves as an ambush, by offering to flies and other insects upon which the Tarantula feeds, an enticing resting-place. Who shall tell us all the stratagems employed by this adroit and intrepid hunter?"

The months of May and June are the most favourable season for hunting the Tarantula. "The first time," says M. Dufour, "that I discovered the holes of this spider, and had satisfied myself that they were inhabited, by perceiving him stationed at the first stage of his dwelling, (the bend already described,) I thought the best way to obtain possession of him would be to attack him by open force, and follow him to the termination of his burrow. I passed whole hours in opening the intrenchment with my knife in order to sack his domicile. I dug to the depth of more than one foot, over a space two feet in width, without meeting with the Tarantula. I recommenced my operations in other holes, and always with as little success. I ought to have had a pickaxe to obtain my end; but I was far from any house, and in Spain. I was then obliged to change my plan of attack; and I had recourse to stratagem. Necessity, they say, is the mother of invention. It occurred to me to take, by way of bait, a stalk surmounted by a spikelet, and to shake it and rub it gently against the opening of the hole. I was not long in perceiving that the attention and desire of the Tarantula were awakened. Tempted with this lure, he advanced with a slow and irresolute step, towards the spikelet; and, upon my drawing it back a little out of the hole, in order to leave him no time for reflection, he threw himself at one spring out of his dwelling, the entrance of which I instantly closed. In this case, the Tarantula, greatly disconcerted to find himself unable to re-enter his home, was very awkward in his attempts to elude my pursuit; and I compelled him to take up his quarters in a piece of paper, in which I instantly shut him up.

"It sometimes happened that, suspecting the snare, or,

perhaps, less pressed by hunger, he held back immoveable, at a little distance from his door, which he did not judge it advisable to pass, until my patience was completely exhausted. When this occurred, these are the tactics I made use of:—After having well observed the direction of the hole and the position of the spider, I drove in with force, and in an oblique direction, the blade of my knife, in such a manner as to surprise the creature behind, and cut off his retreat by stopping up the hole. I seldom missed my aim, especially in ground which was not stony. In this critical situation, either the terrified Tarantula quitted his covert, to make his escape, or he persisted, obstinately, in remaining driven up against the blade of the knife. Upon this, with a sudden sweep of the knife, I threw out both the earth and the spider, and seized upon the latter. By this method of capture, I sometimes took as many as fifteen Tarantulas in an hour.

"In some cases, when the Tarantula was quite aware of the deceit which I was practising, I have been not a little surprised, on my pushing in the spikelet, so as even to touch him in his den, to see him play with it contemptuously, and push it back with his claws, without giving himself the trouble to seek the further end of his retreat."

The Apulian peasants, we learn from Baglivi's account, hunt the Tarantula, imitating, at the mouth of the hole, the humming of an insect, by means of an oaten stalk.

The Tarantula, frightful as it is, at first sight, especially when one is impressed with the idea of danger from its bite, and shy as it appears, is yet very capable of being tamed: M. Leon Dufour kept one alive for more than five months, and of which he relates as follows: "During my stay at Valencia, in Spain, I took, without hurting him, a Tarantula

of tolerable size, which I imprisoned in a glass covered over with paper, in which I had made a square opening. In the bottom of the glass, I had fixed the roll of paper in which I had carried him, and which was to serve him for a dwelling. I placed the glass upon a table in my sleeping-room. He quickly accustomed himself to his cell, and became so familiar that he would come to eat out of my fingers the living fly that I brought him. After having given his victim its death-wound with his jaws, he did not content himself, like most spiders, with sucking the head, but bruised all its body, by plunging it successively into his mouth, with his feelers. He then threw away the remains, and swept them to a distance from his hiding-place. After his repast, he seldom omitted attending to his toilet, which consisted in brushing, with his fore-feet, his feelers and mandibles, without as well as within; and having done this, he resumed his attitude of immoveable gravity. The evening and night were his times of walking and attempting to escape, and I often heard him scratching the paper walls of his prison. These nocturnal habits confirmed my opinion, that the greater number of spiders have, like cats, the faculty of seeing by night as well as by day."

M. Leon Dufour gives this animated description of a mortal combat between two full-grown and very vigorous male Tarantulas, which he put together in a glass vase, that he might witness the spectacle. "After having many times made the circuit of their arena, in the endeavour to shun each other, they hastened, at a given signal, to set themselves in a warlike attitude. I saw them, with surprise, taking their distance, and gravely rising upon their hind legs, so as to present to each other the buckler formed by their chests.

After having looked each other in the face for about two minutes, and without doubt, provoked each other by glances which I could not discern, I saw them throw themselves upon one another, entwine their legs, and endeavour in an obstinate struggle, to wound each other with the hooks of their mandibles. Either from fatigue, or by mutual consent, the combat was for a while suspended: there was a truce for some seconds; and each wrestler, retiring to a little distance, resumed his menacing posture. This circumstance reminded me that in the single encounters of cats, there are also suspensions of arms. But the struggle was not long in recommencing, with more fury than before, between the two Tarantulas. One of them after victory had been, for a long time, doubtful, was at length overthrown, and mortally wounded in the head; and he became the prey of the vanquisher, who devoured him. After this murderous combat, I kept the victorious Tarantula alive for many weeks."

THE LEAF INSECT, OR WALKING LEAF.

Among the curiosities of Entomology, the insect which appears to be one of the leaves among which it rests, is not the least curious creature. The rich collection of specimens in the British Museum, is described as so exactly like pieces of dry twig, that it would be impossible, without due investigation, to discern the difference—while others (as may be seen from a most beautiful specimen, that must attract the notice of every visitor) elude detection in a similar manner by means of large green or brown wings, that both as regards colour and texture, are exactly like the fresh or dead leaves of a tree.

This family of insects has long been known through a species named by Latreille and succeeding naturalists, *Phyllium siccifolium:* it was long supposed there was but one species, but Mr. G. R. Gray, availing himself of the British Museum collection, has described thirteen species, nine of which are new. The family seems peculiar to the Eastern world: three of the thirteen being brought from the Philippine Islands, three from the East Indies and Ceylon, one from Java, one from Mauritius, and one from the Seychelle Islands. The locality of the remaining four species (among which is the old *Phyllium siccifolium*) is unknown. The *Phyllium scythe* we have now to describe, is brought from Silhet, and the mountainous districts of India adjoining Assam. Specimens of the female not unfrequently occur in the cases of insects sent from the above country, but the male comes much more rarely. Mrs. Major Blackwood found both males and females, as well as the young insect in all stages, plentiful in the valleys below Cherrapoonjee in the Kasiat Hills, which form part of the southern boundary of the valley of Assam.

In the spring of 1854, Mrs. Blackwood forwarded to Edinburgh a supply of eggs, whence a pair of insects came out on the 9th and 10th of May; one or two followed weekly, till the end of May, when a week or two of cold weather occurred, during which no more came out; but when fine weather returned, in June, the insects began to come out in great numbers, from one or two of which was reared a specimen to perfection. A fuchsia was first tried as its food, but this the insect soon left for the common myrtle. It never sought to leave the plant till it was full grown, and was furnished with wings, when it was found necessary to put

a muslin bell-shaped cover over the plant, to prevent the insect flying away. It was kept in a hothouse of the Royal Botanic Gardens of Edinburgh; the temperature of the house being as nearly 55° as could be maintained.

The metamorphosis and growth of this very curious insect have been ably illustrated by Mr. Andrew Murray, in No. 5 of the *Edinburgh New Philosophical Journal.* Belonging to the Orthopterous order of insects, which undergo only a partial or incomplete metamorphosis; they pass the larval phase of their existence in the egg; pass their pupa state in an active six-legged, but unwinged, form, after coming out of the egg; and the perfect insect only is seen when the wings are developed. Such is the general opinion, but Mr, Murray submits, after careful consideration of what he has observed of this Leaf-insect, that both the larval and chrysalid states are passed in the egg. We have not space for the details of Mr. Murray's argument: his picture of the beautiful economy of the egg of the insect, and its peculiar provision is thus told: "The egg is about the size of a small pea, barrel-shaped, and with six longitudinal ribs; it looks uncommonly like some seeds. The ribs are all placed at equal distances except two, which are wider apart, and the space between them flatter, so that on the egg falling it rolls over till it comes to this flatter side, and there lies. The outside is rough and corrugated like the bark of a tree, and is penetrated by rows of large longitudinal holes, on each side of the ribs, and by rows of smaller holes between them. At the top there is a little conical lid fitting very tightly to the mouth. On the outside, the lid is composed of the same bark-like structure as the outside of the body of the egg. and has its base surrounded by frill-like projections, which at

first sight one might take for an apparatus for holding on the lid, but closer inspection shows they belong to the lid itself. On removing the lid, we see a beautiful porcelain chamber of a pale French-white colour. On holding this shell between us and the light, we see light spaces where the holes in the cortical outer covering terminate, and in the centre of each there is a darker space, as if it were a pore; but this conjecture Mr. Murray has not been able to verify. The substance composing the outer cortical covering is very curious. It is very thick. Looked at with the naked eye, it seems of a spongy, reticulated fibrous structure. But, under the microscope, we see that it is composed of cells, generally arranged in rows radiating outwards; and in some parts, both in substance and structure, bearing a striking resemblance to a piece of honeycomb. "It seems not difficult to conjecture the purpose which the cellular texture of this outer covering serves. If it had been of a firm close substance, the embryo insect could not have received the amount of air and moisture necessary for its existence, and which is more than usually necessary in this family of insects."

We now proceed with the metamorphosis and growth. "After having reached the form of a six-legged insect, it emerged from the egg by pushing off the lid. It came out middle foremost, that is, head and tail were packed downward, so as to meet each other, and were drawn out after the back had appeared; the legs being extricated last. The colour of the insect at this stage was of a reddish yellow, something of the hue of a half-dried beech-leaf; for, it is to be observed, that without the colour of the insect varies at different periods of its life, it always, more or less, resembles

a leaf in some stages. When it had once settled to eat the leaves on which it was placed, the body speedily became bright green. Among the leaves of the common myrtle, it could not be distinguished by the colour of the body (the legs were browner); and its manner of carrying itself tended to aid the deception. "It bore its tail generally curled up a little, just as much bent as the myrtle leaf. As it bent its tail up, however, the curl would have been the wrong way, unless the insect walked back downmost, which, in point of fact was its constant habit, adhering to the underside of the leaves. This habit brought to light another beautiful contrivance for still further heightening its resemblance to a leaf. The upper surface was opaque green, the under surface glossy, glittering green, just the reverse of the myrtle or guava leaf; so that, by reversing its position, it brought the glossy side up, and the dull side down. It was provided with tarsi, to suit this upside-down mode of life. Between each of the claws there was a large spongy pad, which, as with flies walking on the ceiling, enables the insect to adhere firmly to the leaf; indeed, it was always difficult to disengage its hold of anything it stuck to."

The Leaf-insect is subject to three moults, as is generally the case with the Orthoptera. The first moult took place about ten months after the hatching: the insect had increased very gradually but not greatly in size: it was not an inch in length when hatched, and at the first moult it measured not much more. At the third moult the full-grown wings and antennæ were produced. The day previous to the casting of the skin, the insect was observed to be unusually lively, shaking and working about with its body, while the feet seemed firmly attached to the leaf. Before the moultings,

the insect became of a greyish tinge, doubtless, caused by the skin having become loose through the shaking process alluded to.

The insect ate up the second skin before it could be secured. Mr. Murray is not aware whether this singular act of cannibalism has been observed in other insects after moulting. But Mr. Thomas Bell, in his *History of British Reptiles*, records a similar instance in the toad. Having described the proofs of divesting itself of its skin, which he had witnessed in the common toad, he says: "The whole cuticle was thus detached, and was now pushed by the two hands into the mouth in a little ball, and swallowed at a single gulp." This piece of epicurism does not strike Mr. Murray as so extraordinary in the toad as in the Leaf-insect: "the toad lives on animal food; but the insect whose food is exclusively vegetable, has surely made a curious deviation from its instincts, unless we are to hold that the Leaf-insect not only looks like a leaf, but also tastes like a leaf."

After each of the moultings, the insect assumed a beautiful emerald green colour, while after the last moult the body had a slight tinge of yellow round it. It subsequently became gradually yellower, and brownish at the edge, passing through the different hues of a decaying leaf. Like the leaf it resembled, and fed upon, it seemed to decay on arriving at maturity; and, what is very remarkable, it fell

into the scar, the yellow leaf,

at the period of the year when the foliage assumes its autumnal tint, namely, in the end of September and beginning of October. "How far," remarks Mr. Murray, "the causes which bring about this result resemble each other in plants and

animals will be an interesting subject of inquiry to the physiologist, when we have a better supply of the insect to experiment upon." The above insect died in October, 1855.

An insect of kindred interest to the above, has since been described by Mr. Murray, who received a photograph of it from Dr. Traill, at Russellcondah, in the Madras Presidency. In Singapore and the Straits, where a variety of leaf-insects are found, Dr. Traill had become accustomed to their forms, but by the above specimen he was completely taken in, and until the animal moved, he thought it a dead leaf. To his surprise, he found it to be a *butterfly!* When at rest, its two anterior wings were pushed forward in front of its head, so that a central line on them exactly met a similar central line on the posterior wings, and thus simulated the mid-rib of a leaf. The four wings thus disposed presented a most exquisite resemblance to an autumnal leaf, especially when the animal was held two or three feet from the eye of the spectator. Unfortunately, a remorseless rat one night carried off the insect, along with the pin on which it was impaled; but Dr. Traill had, a few days before, obtained a photograph of the insect, which he describes as very far from giving a just idea of the original. The upper sides of the wings were most brilliantly coloured, but, of course, could only be seen when the insect was in motion; when at rest, and more exposed to danger, the folding back of the wings concealed them, and showed only this extraordinary resemblance to a leaf, which was every whit as great as that exhibited by the insect proper, only being that of a dead leaf instead of a green one.

Mr. Murray considered this insect to be undescribed, and that, from its powers of concealment, it is rarely captured. Most butterflies have lines on the anterior and posterior

wings, often both above and below, which become continuous when placed in juxtaposition. There are several exotic species which have a line similar to the mid-rib of a leaf figured upon the under-sides of the wings; but none hitherto described, says Mr. Murray, at all approach the present in its close resemblance to a leaf,—in shape, veining and shading.

Better known is the Mantis, a species of cricket, of which Blumenbach enumerates four varieties:—the Gigantic, from Amboyna, a span long, yet scarce as thick as a goose-quill, and eaten by the Indians. 2. Gonglyodes, from Guinea. 3. The Religious Mantis, or Praying Cricket. 4. Another at the Cape, and considered sacred by the Hottentots.

The best known is the third variety. It mostly goes on four legs, holding up two shorter ones: the hind legs are very long, the middle ones shorter. It is sometimes called the *Dried and Walking leaf*, from the resemblance of its wing-covering, in form and colour, to a dry willow-leaf. It is found in China and South America; and in the latter country, many of the Indians believe that these Mantises grow on trees, like leaves, and that having arrived at maturity, they loosen themselves, and crawl or fly away.

Mr. Carpenter, the microscopist, dissected the head of this Mantis, in which he found large and sharp cutting teeth; also strong grinding ones, similar to those in the head of locusts; the balls at the ends fitting into sockets in the jaw. The whole length of the insect is nearly three inches: it is of slender shape, and in its sitting posture holds up the two fore-legs slightly bent as if in an attitude of prayer, whence its name: for this reason, superstition has held it a sacred insect, and a popular notion has prevailed, that a child or a traveller having lost its way, would be safely directed by

observing the quarter to which the animal pointed, when taken into the hand.

Its real disposition is, however, very far from peaceable: it preys with great rapacity on smaller insects, for which it lies in wait, seizes them with a spring, and devours them. And when kept captive with another of its own species, it will attack its fellow, and persevere till it has killed its antagonist. Roësal, the naturalist, who kept some of these Mantises, describes their manoeuvres in their conflicts as very much resembling those of hussars fighting with sabres; and sometimes the one cleaves the other through, or severs the head from its body with a single stroke. During these engagements, the wings are generally expanded, and when the battle is over, the conqueror devours his vanquished foe.

Among the Chinese this pugnacious disposition in the Mantis is converted into an entertainment, resembling that of fighting cocks and quails; and it is to this insect that Mr. Barrow refers in his *Account of China*, as follows: "They (the Chinese) have even extended their inquiries after fighting animals into the insect tribes, and have discovered a species of locusts that will attack each other with such ferocity, as seldom to quit their hold without bringing away at the same time a limb of their antagonist. These little creatures are fed and kept apart in bamboo cages; and the custom of making them devour each other is so common, that during the summer months, scarcely a boy is to be seen without his cage of locusts."

Roësal satisfied himself of the innate ferocity of the Mantises. He placed a bag of eggs in a large inclosed glass. From the time they were hatched, they were very savage. He put various plants into the glass, but they refused them

in order to prey upon each other. He next tried insect food, and put several ants into the glass to them, but they then betrayed as much cowardice as they had before shown of barbarity; for the instant the Mantises saw the ants, they attempted to escape in every direction. Roësal next gave them some common house-flies which they seized with eagerness with their fore-claws, and tore in pieces. Notwithstanding this apparent fondness for flies, the Mantises continued to destroy each other. Despairing, at last, from their daily decrease, of rearing any to the winged state, Roësal separated them into small numbers in different glasses; but here, as before, the strongest of each community destroyed the rest. He afterwards received several pairs of Mantises in the winged state, which he placed, a male and female together, in different glasses; but they still showed a rooted enmity towards each other, which neither age nor sex could mitigate. The instant they came in sight of each other, they threw up their heads, brandished their fore-legs, and each waited the attack. They did not, however, long remain in this position; for the boldest throwing open his wings, rushed at the other, and often tore his antagonist in pieces.

VI.

STORIES OF SERPENT LIFE.

THE most recent account which we possess of the nature of Serpents is that by Professor Owen, who, in his work on British Reptiles, thus describes these extraordinary creatures. "Anatomy unfolds to us that their parts are as exquisitely adjusted to the form of their whole, and to their habits and sphere of life, as in the organization of any animal which we call superior to them. It is true the serpent has no limbs, yet it can outclimb the monkey, outswim the fish, outleap the jerbóa, and suddenly loosing the close coils of its crouching spiral, it can spring into the air and seize the bird upon the wing; thus all these creatures fall its prey.

"The serpent has neither hands nor talons, yet it can outwrestle the athlete, and crush the tiger in its folds. Far from licking up its food as it glides along, the serpent lifts up its crushed prey, and presents it, grasped in the death-coil, as in the hand, to the gaping, slime-dropping mouth. It is truly wonderful to see the work of hands, feet, fins, performed by a simple modification of the vertebral column in a multiplication of its joints, with mobility of its ribs.

"As serpents move chiefly on the surface of the earth, their danger is greater from pressure or blows from above: all the joints are accordingly fashioned to resist yielding, and to

sustain pressure in a vertical direction; there is no natural undulation of the body, upwards and downwards, it being permitted only from side to side. So closely and compactly do the ten pairs of joints between each side of the two or three hundred vertebræ fit together, that even in a relaxed and dead state, the body cannot be twisted, except in a series of side coils.

"When we call to mind the anatomical structure of the skull, the singular density and structure of the bones of the cranium strikes us as a special provision against fracture and injury to the head. When we contemplate the remarkable manner in which all the bones of the skull overlap one another, we cannot but discern a special adaptation in the structure of serpents to their commonly prone position, and a provision to the dangers to which they were subject from falling bodies, and the tread of heavy beasts. But the whole organization of the serpent is replete with many other such beautiful instances of foresight and design.

"What, however, more particulary concerns us in the relation of the serpent to our history, (in the Serpent of the Bible,) is the great and significant fact revealed by paleontology, viz. that all these peculiarities and complexities of organization, in designed subserviency to a prone posture and a gliding progress upon the belly, were given by a beneficent Creator to the serpent of that early tertiary period of our planet's history, when, in the slow and progressive preparation of the earth, the species which are now contemporaries, were just beginning to dawn; these, moreover, being species of the lowest class of animals, called into existence long before any of the actual kinds of mammalia trod the earth, and long before the creation of man."

Serpents are, strictly speaking, to be classed as viviparous, rather than oviparous. True, their young are formed in a sort of shell, or loose skin, and continue in the egg state till they are brought forth; but the eggs are, so to speak, hatched inside the serpent, and the young ones are brought forth like those of any other viviparous animal: hence the general name of *Vipers*, a contraction of *Vivipares*. Sometimes eggs are found, which, from their resemblance to those of the serpent, are mistaken for the latter; but, on a closer examination, they invariably turn out to be the eggs of the lizard, which is oviparous. In the island of St. Lucia, in the West Indies, are serpents, boas, and snakes, of almost every variety; but no species has ever been known to produce eggs, and hatch them in the ordinary manner; which fact was verified from specimens sent, some years ago, to the gardens of the Zoological Society, in the Regent's Park. A Correspondent of *Notes and Queries*, who was resident at St. Lucia, was present when a female serpent of the venomous kind, having received a blow of a cutlass across the belly, there immediately issued from the wound several young ones, all alive. They were about ten inches long, and remarkably vivacious, protruding their little tongues, and snapping their fangs at every object that was presented to them. We shall now proceed to the general history of these remarkable creatures.

First, as to the size of Serpents. We find at an early period the human mind was brought into so extraordinary a state of unmeaning credulity, with regard to the size and wonderful properties of Serpents, that, if we had not the statements on record, they would be almost beyond belief. The account of Attilius Regulus, the Roman General in

Africa, who encountered a serpent in that country 120 feet long, which neither he nor his army could subdue without discharging all their engines of war against it, is one of a multitude of stories, which are gravely stated by Pliny, Ælian, Olaus Magnus, Gesner, and many others. Indeed, Serpents afford Pliny a theme for inexhaustible wonders. He says that he himself saw the skin of the above serpent, which was 120 feet long, and that it had destroyed many of the army. At last, however, the battering engines were brought out against it; and these assailing it at a distance, it was soon destroyed. Its spoils were carried to Rome, and the general was decreed an ovation for his success. The skin was kept for several years after in the Capitol. Goldsmith credits this account, saying, "though Pliny was a credulous writer, he was by no means a false one, and whatever he says he has seen, we may very safely rely on." One of the strangest of his relations is where he tells us that serpents, "when they have stung or bitten a man, die for very greefe and sorrow that they have done such a mischeefe."

Pliny attempts to justify the story of the 120-feet serpent by observing that, in the reign of Claudius, there was a large boa killed in the Vatican, in whose stomach was found the entire body of an infant. Now, the fact that the body of an infant was capable of being received into the stomach of a serpent is unquestionable; for not only are some of the large boas capable of swallowing an animal the size of an infant, but also dogs, deer, and even oxen after they have been crushed between their folds, and covered with saliva. But what need, therefore, is there that animals possessing such a capacious stomach should be 120 feet in length? On the contrary, the great serpent of the Sunda islands, which

is nearly, if not quite, the largest known species, does not generally much exceed thirty feet. The statement of Ælian, that Alexander saw in the Red Sea serpents thirty cubits long, and that also of Strabo, that draconic monsters were seen by Alexander's ambassadors from 80 to 140 cubits in length, are perfectly gratuitous, and could have their origin in nothing higher than a desire to satisfy the demands of the wonder-making, superstitious people to whom they wrote. However, this extraordinary length is adopted by Professor Owen, who, in his History of Serpents, says: "in Norway, we read of two serpents of very large proportions: one of 200 feet long, which lives in rocks and desolate mountains, near the sea, about Bergen; which in summer nights ranges about in quest of plunder, devouring lambs, calves, swine, and other animals that fall in its way. In a calm sea it ransacks the superficies of the water, and devours the polypus, and all sorts of sea crabs. Upon the approach of a ship, this serpent lifts up its head above water, and snatches at the mariners. My author adds, that it rolls itself round about the ship, the more effectually to secure its prey. The other serpent is in the diocese of Hamoner, about fifty cubits long by conjecture. In Bothnia, on the Livonian sea, we read of monstrous serpents, with which the shepherds of that country were in constant war. Wonderful things are reported of the large serpents that infest the Helvetian mountains."

The Asp will be recollected as a famous serpent of antiquity. This noxious serpent is celebrated as the instrument of death, which Cleopatra, queen of Egypt, is said to have selected to terminate her existence. Her fate belongs to the romance of history. After the decisive battle of Actium,

on the death of Antony, Cleopatra committed suicide, in order to avoid the humiliation of being led in the triumphal procession of Octavianus. Most probably, she took poison. According to the story of Plutarch, she was closely watched by order of Octavianus, who suspected her designs, but she procured an asp to be introduced in a basket of figs. The queen, after using her bath, and partaking of a sumptuous repast, applied the deadly serpent to her arm. Two of her female attendants died with her. The emissaries of Augustus, who had received a letter from Cleopatra, declaring her intention, came too late to save her for a Roman triumph. They found her body lying on a golden couch in her royal robes, with one of her attendants dead by her side, and the other with just strength enough remaining to fix the diadem on the head of her mistress.

The catastrophe as described by Plutarch, has been closely followed by Shakspeare, in the closing scene of *Antony and Cleopatra*, where Cæsar exclaims over the body of the queen and Charmian :—

> If they had swallow'd poison, 't would appear
> By external swelling: but she looks like sleep,
> As she would catch another Antony
> In her strong toil of grace.

And one of the guards traces upon the Queen's breast—

> This is an aspick's trail; and these fig-leaves
> Have slime upon them, such as the aspick leaves,
> Upon the caves of Nile.

The Asp—the modern Haje, and closely allied to the Cobra Capello, from its power of swelling out the neck when irritated, is thought to be identical with the Puff-adder of the Cape of Good Hope, so called from its power of puffing out or distending

the neck and throat when provoked. Pliny tells us that the Asp, otherwise so much to be dreaded, has a sentiment, or rather a kind of affection, truly wonderful. It never lives alone, the male and female being constantly found together, and if one happens to be killed, the other seeks with the utmost fury to avenge its death. It knows and selects the destroyer from among crowds, and can rarely be deprived of its revenge. Yet this reptile, so terrible from the deadly effects of its poison, has a very indifferent vision; its eyes being placed on the side of the head, prevents its seeing straight before it, so that it is frequently trodden under foot before aware of its danger. The jugglers of Grand Cairo tame the Haje, and teach it to dance, taking care to deprive it of its poison-fangs. The habit which this serpent has of erecting itself when approached, made the Egyptians imagine that it guarded the places which it inhabited. They made it the emblem of the divinity which they supposed to protect the world; accordingly they have represented it on their temples sculptured on each side of a globe.

The artistic representations of Serpents are very numerous and suggestive. Raphael has painted the Serpent, with a human head, tempting Eve. In the College of Arms, the Arundel MS. No. 23, containing the genealogical descent of King Edward IV. and apparently coëval with that sovereign, the Serpent is represented with a human head; as also in a beautifully executed sketch of Adam and Eve, in a MS. in the same College, of the time of Henry VII., at the commencement of *The Genealogy of the Saxon Kings from Adam.* They are both female heads; the latter, however, being the entire bust. In the east window of the Lady Chapel, Wells Cathedral, (*temp.* Edward III.,) the Serpent, which is entwined

round a tree, and holds an apple, has not only the head but the upper half of a human figure.

St. Hilary is usually represented with three books. In Callot's *Images*, he is treading on serpents, and accompanied by the text Numbers xxi., where the mourning Israelites are bit by fiery serpents, and they repenting, are healed by a brazen serpent, which Moses made, and put upon a pole: "and it came to pass, that if a serpent had bitten any man, when he beheld the serpent of brass, he lived." Both the above emblems allude to St. Hilary's opposition to Arianism: the books signify the treatises he wrote against it, and the serpents the false doctrines and heresies which he overthrew.

In Didron's splendid work, the *Iconographia*, we have several references to ancient representations of our blessed Lord treading the dragon under foot; and sometimes the lion, the asp, and the basilisk, are added.

The *Conception* is generally represented in Christian art by a figure of Mary setting her foot, as second Eve, on the head of the prostrate serpent, in allusion to Genesis iii. 15, and thus we find it in Callot's *Images*. Mrs. Jameson, in her *Legends of the Madonna*, says: "not seldom, in a series of subjects from the Old Testament, the pendant to Eve holding the apple is Mary crushing the head of the fiend, and thus the bane and antidote are both before us."

At Melbury Bubb church, in Dorsetshire, is a very curious font, in which the sculpture is all upside down. All the beasts and other animals are on their heads, and they are all rolled together *by the folds of a snake*, which may be emblematical of the world's sin. The serpent is much employed in mystic sculpture: the altar-tomb of Sir Hans Sloane, in the churchyard of Old St. Luke's, Chelsea, is surmounted by an

oviform vase, entwined with serpents, emblematic of the pursuits of Sir Hans Sloane, as a naturalist, and man of science.

In an inventory of goods belonging to Archbishop Holgate, we find "a Serpent's Tongue set in a standard of silver, gilt and graven." This tongue is the fossil now commonly termed a Shark's tooth. "In former days," says Mr. Pinkerton, few pilgrims returned from the East without bringing, at least, one of these curious stones, now termed the Tongues of St. Paul. Being principally found in Malta, it was said they were the tongues of the vipers, which once infested that island, and which St. Paul had turned into stone. Considered to be antidotes, and possessed of talismanic qualities, they were set in cups, dishes, knife-handles, and other requisites for the table."

Here may be mentioned that Keynsham, the hermitage of Keynes, a Cambrian lady, A.D. 490, was infested with serpents, which were converted by her prayers into the "Serpent Stones"—the *Cornua Ammonis*—that now cover the land. A similar story is told at Whitby, where these fine fossils are called "St. Hilda's Serpent Stones;" and so, too, St. Godric, the famous hermit of Finchale, near Durham, is said to have destroyed the native race of serpents.

Many of us remember reading the Voyages of Sinbad: the stories of the monstrous serpents in the Valley of Diamonds, and of the "Serpent of surprising length and thickness, whose scales made a rustling as he wound himself along," that swallowed up two of the sailor's companions, probably had their foundation in traditions of the size and strength of a family of serpents belonging to the Old World, but nearly allied in organization and habits to the Boas. Sinbad's de-

scription, indeed, of the fate of the first of the two victims brings to our memory a terrible anecdote of the murderous power and voracity of the Indian boas or pythons related in modern times. "It" (the Serpent) swallowed up the fictitious sailor, "one of my comrades, notwithstanding his loud cries and the efforts he made to extricate himself."

Of the same race, probably, were the monsters to which frequent allusions are made by ancient writers. Aristotle writes of Serpents of enormous size on the Lybian coast, which overset one of the triremes by which they were pursued. The two monstrous snakes sent by Juno to strangle the infant Hercules in his cradle, described by Theocritus, in his 24th Idyll, exhibit some of the peculiarities of these reptiles. The way in which Theocritus represents them to have rolled their folds around the boy, and relaxed them when dying in his grasp, indicates the habit of a constricting serpent. The incident will be found in the first Nemæan Ode of Pindar. thus beautifully imitated by Cowley :—

The big-limb'd babe in his huge cradle lay,
Too weighty to be rock'd by nurse's hands,
Wrapped in purple swaddling bands :
When lo ! by jealous Juno's fierce commands,
Two dreadful serpents came,
Rolling and hissing loud into the room :
To the bold babe they trace their hidden way :
Forth from their flaming eyes dread lightning went ;
Their gaping mouths did forked tongues like thunderbolts present.

* * * * * * *

The mighty infant seem'd well pleas'd
At his gay gilded foes :
And as their spotted necks up to the cradle rose,
With his young warlike hands on both he seized :
In vain they rag'd, in vain they hiss'd,
In vain their armed tails they twist,

And angry circles cast about;
Black blood, and fiery breath, and poisonous soul, he squeezes out.

With their drawn swords
In ran Amphitryon and the Theban Lords,
With doubting wonder, and with troubled joy,
They saw the conquering Boy
Laugh and point downwards to his prey,
Where in Death's pangs, and their own gore they folding lay.

Virgil's Laocöon, and the unrivalled marble group, which the poet's description most probably called into existence, owe their origin undoubtedly to the stories current of constricting serpents. According to Pliny, Megasthenes writes that serpents grow to such a size in India that they swallowed entire stags and bulls. Suetonius mentions the exhibition of a serpent 50 cubits in length. To come to more modern accounts, Bontius says, "the Indian serpents sometimes exceed 36 feet in length, and are of such capacity of throat and stomach that they swallow entire boars." He then speaks of the great power of the distension of the jaws, adding, "to confirm this, there are those alive who partook with General Peter Both of a recently swallowed hog, cut out of the belly of a serpent of this kind. They are not venomous, but they strangle by powerfully applying their folds around the body of a man or other animal." All these gigantic serpents were, most probably, the Pythons of modern naturalists.

M'Leod, in his *Voyage of H.M.S. Alceste*, 1817, during a captivity at Whidah, in the kingdom of Dahomey, on the coast of Africa, observed snakes who killed their prey precisely as boas do, and swallowed animals much larger than goats or sheep. Abson, governor of Fort William, had seen snakes thus overpower the smaller cattle. A negro herdsman, who afterwards limped about the fort for many years, had been

seized by one of these serpents by the thigh, but being in a wood, the serpent, in attempting to throw himself around him, got entangled with a tree; and the man being thus preserved from a state of compression, which would have instantly rendered him quite powerless, had presence of mind enough to cut with a large knife which he carried about with him, deep gashes in the neck and throat of his antagonist, thereby killing him, and disengaging himself from his frightful situation. He never afterwards, however, recovered the use of that limb, which had sustained considerable injury from the serpent's fangs, and the mere force of his jaws.

According to Pliny, the name of *Boa* was given to certain serpents because they were said to be first nourished from the milk of cows; and Jonston and others observe, that they derived the name not so much from their power of swallowing oxen, as from a story current in old times, of their following the herds and sucking their udders. Boa is also stated to be the Brazilian name for a serpent.

If you look at the beautiful preparation of the skeleton of a Boa Constrictor, in the British Museum, you may observe the strong close-set teeth, of which there is a double row on each side of the upper jaw, all pointing backwards, and giving the serpent the firmest hold of its struggling victim, which is thus deprived of the power of withdrawing itself when once locked within the deadly jaws, which are very powerful. The spine is formed for the most extensive mobility, and the multitude of ribs constructed as organs of rapid progression, when joined to the belly scales, or scuta, with which the whole inferior surface of the body may be said to be shod. "When the Snake," writes Sir Everard Home, "begins to put itself in motion, the ribs of the opposite sides are drawn apart from

each other, and the small cartilages at the end of them are bent upon the upper surfaces of the abdominal scuta, on which the ends of the ribs rest; and, as the ribs move in pairs, the scutum under each pair is carried along with it. The scutum, by its posterior edge, lays hold of the ground and becomes a fixed point from whence to set out anew." An observation of Sir Joseph Banks, during the exhibition of a large snake, is said to have first led to this discovery of the serpent's motion. While it was moving briskly along the carpet, he said he thought he saw the ribs come forward in succession, *like the feet of a caterpillar.* This remark led Sir Everard Home to examine the animal's motion with more accuracy, and on putting his hand under its belly, while the snake was in the act of passing over the palm, the ends of the ribs were distinctly felt pressing upon the surface in regular succession, so as to leave no doubt of the ribs forming so many pairs of levers, by which the animal moves its body from place to place.

In examining the skeleton, especial notice should be taken of the under surface of the vertebræ, on which will be seen the protuberance for the attachment of the muscles which are employed in crushing the animals round which the snake entwines itself.

We read of these reptiles, in their native country, holding on by their tails to a tree, their heads and bodies in ambush, and half floating in some sedgy river, they surprise the thirsty animals that seek the stream. There are also hooks which help the serpent to maintain a fixed point; they become a fulorum, which gives a double power to his energies.

McLeod has given a painfully vivid account of a Serpent, a native of Borneo, sixteen feet long, and eighteen inches

in circumference, which was on board the *Alceste*, being fed with a goat: this the Serpent having killed in its folds, almost instantaneously, then covered it with saliva, and sucked the goat in, with great distention; this swallowing occupied more than two hours, and then the snake lay for three weeks or a month, to digest his meal, when he was presented with another goat, which he killed and devoured with equal facility. Mr. Broderip has described a similar feeding of a Boa with rabbits and fowls. Now, it is remarkable that in the two cases was this difference: the goat was terrified when put in to the Boa on board the *Alceste*, which Mr. Broderip attributes to the Boa and goat being both natives of Java: "they would, according to the wonderful instinct which nature has implanted in animals for their preservation, be likely to have a violent antipathy to large Serpents, such as those which there lurk for their prey," thus accounting for the instinctive horror of the goats. But, indifferent to the other Boa, were the rabbits and fowls: they having no such natural enemy as a large Serpent, against which it was necessary for them to be on their guard, are entirely without the former instinct, although it is strong enough in the case of their ordinary enemies, such as hawks, dogs, and cats; and they consequently view the Boa which is about to dart at them, with the same indifference as if he were a log of wood. Mr. Broderip also relates that he once saw at Exeter 'Change, a hen destined for the prey of a Boa, very comfortably at roost upon the Serpent, who took no notice of the hen when it was held up to him.

It will now be interesting to glance at the veneration in which Serpents have been held in all ages.

Serpent Worship was also called Obeahism. In Astley's

Collection of Voyages there is an account compiled from every authority then known, and a very interesting description of the rites and ceremonies connected with this superstition. The influence of the Obeist does not depend on the exercise of any art or natural magic, but on the apprehensions of evil infused into his victim's mind.

The name of the sacred Serpent, which, in the ancient language of Canaan, was variously pronounced, was derived from Ob, or Python; and it is a curious coincidence, that as the Witch of Endor is called Oub, and the African sorceress "Obi," from the Serpent deity, *Oub*, so the old English name of a witch, "hag," bears apparent relationship to the word *hak*, the ancient British name of a species of snake. In Yorkshire, according to Stukeley, they call snakes "hags," and "hag-worms."

There is scarcely a heathen nation that has not adopted some deity in the form of a Serpent. Among those who were foremost in this form of idolatry, were the Egyptians, who built chapels underground, where they carefully fed and worshipped them. In the time of Herodotus, serpents were kept tame at Thebes, adorned with jewels, and consecrated to Jupiter. When they died, they were buried with divine honours, and placed in urns in the temple of Jupiter. And, according to Ælian, they were admitted into the houses of the Egyptians, and there treated as household gods. It is said that Jotham, King of Israel, built much on the wall of Ophel, that is the Serpent god; and this animal was the first form under which Cnaphis or Agathodemon of the Egyptian pantheon was worshipped by the inhabitants of the Thebaid.

But, although this creature was worshipped by many nations in the East, the Babylonians, Arabians, Scythians,

Phœnicians, Macedonians, and many others; yet in India, and more particularly on the coast of Malabar, this form of worship attained its greatest height of absurdity. The King of Calicut, who was formerly the most powerful of all the Malabar princes, was so much enslaved by the worship of these creatures as to have temples built purposely for them, where they were held sacred, and made the guardians of all their houses, persons, and property. So highly was the serpent considered in the East, that wherever it was figured or painted, the place was held sacred, and the ground consecrated; and the most exalted honour that could be conferred on a hero was to style him "born of a Serpent." Thus, Alexander the Great, and Scipio Africanus, were both said to be born of Serpents. So likewise was the companion of Cadmus, the giant in Homer, and a certain prophet in Pausanias; nay, whole tribes went by the name of Serpent. This was the case with some people inhabiting Cyprus, and around the Hellespont. Even in the primitive church there was a sect called Ophites, or Serpentinians, because they worshipped the Serpent that betrayed Eve, and therefore ascribed supernatural knowledge to that animal.

The most probable origin of Serpent Worship would seem to take its rise in the corrupt and perverted constructions which were put upon the history of Adam and Eve by heathen nations, many of which seem to have received sufficient intimation of this event, and of the record made by Moses, to account for many strange perversions which we read of in mythology.

We often find in Christian legends the conquest of sin or heathenism represented by the obvious symbol of a vanquished dragon. Thus, St. Philip, the apostle, is said to have de-

stroyed a huge serpent at Hierapolis, in Phrygia, as also did St. Martha, the terrible dragon called the Tarasque, which infested the Rhone at Aix. The same service St. Florent performed for the Loire. The Breton saints, Cado, Maudet, and Paull, performed like feats: nor is the famous St. Keyne, of Cornwall, to be omitted. The dragon is also the well-known attribute of the archangel St. Michael, St. George, St. Margaret, and the saintly Pope Sylvester. St. Romaine, Bishop of Rouen, in the seventh century, and predecessor of St. Owen, destroyed a huge dragon called La Gurjoille, which ravaged the shores of the Seine. He was assisted by a felon who had committed murder; whence the chapter of Rouen acquired the annual privilege of pardoning a condemned prisoner. The stained glass windows in the cathedral, the Church of St. Romaine, and other churches in Rouen, have the history of St. Romaine, and the pardon ceremony depicted in brilliant colours. The word Gurjoyle, or Gurjouille, is now used to denote the hideous forms which serve as rain-spouts outside some churches.

"How are we to understand these things," asks M. de Penhouet, "if we do not look upon them as a transparent veil, through which we perceive the efficacy of baptism administered to the followers of Serpent Worship (or idolatry in general), who, upon their conversion, were plunged into the water?" (*Eirionnach; Notes and Queries, No.* 146.)

A great proportion of the innumerable Serpent stories have a deeper foundation than a credulous fancy, or lively imagination. In Deane's *Worship of the Serpent* we read: "The superstition of the "Serpent in the Sea," was known to the Chinese. But it was, doubtless, at one time a very general superstition among the heathens, for we find it mentioned by

Isaiah, chap. xxvii. 1, "In that day, the Lord, with His sore and great and strong sword, shall punish Leviathan the piercing serpent, even Leviathan that crooked serpent: and He shall slay the dragon that is in the sea."

"Serpent-worship," says Dr. Southey, in his notes to *Madoc*, "was common in America." Mr. Bullock describes a great Serpent-idol, which he saw in Mexico: it represents a Boa swallowing a human victim, which is seen crushed and struggling in its horrid jaws. Southey, in these powerful lines, brings before us the Mexican priest, and his snake-god:—

> On came the mighty snake,
> And twined, in many a wreath, round Neolin,
> Darting aright, aloft, his sinuous neck,
> With searching eye, and lifted jaw and tongue
> Quivering, and hiss as of a heavy shower
> Upon the summer woods. The Britons stood
> Astounded at the powerful reptile's bulk,
> And that strange sight. His girth was as of man,
> But easily could he have overtopped
> Goliath's helmed head, or that huge king
> Of Basan, hugest of the Anakim:
> What then was human strength, if once involved
> Within those dreadful coils? . . . The multitude
> Fell prone, and worshipped.
>
> *Madoc.* Book vii.

Partly from the idea of divinity attached to Serpents, and partly from their casting their slough periodically, the Serpent came not only to be a symbol of health and reproduction, but a means of procuring these blessings:—

> As an old serpent casts his scaly vest,
> Wreathes in the sun, in youthful glory drest;
> So when Alcides mortal mould resign'd
> His better part enlarg'd, and grew refin'd.
>
> *Ovid.*

Pliny, Galen, and the ancients are unanimous as to the medicinal properties of the flesh of the serpent when eaten. In modern times, we have many instances. Dr. Donne, in his *Devotions*, has this prayer: "Thou, O Lord, who hast imprinted all medicinal virtues which are in all creatures, and hast made even the flesh of vipers to assist in cordials, art able to make this present sickness everlasting health."

Francis Bacon, in his *Wisdom of the Ancients*, relates the classical fable which accounts for the Serpent being gifted with the power of restoring youth. The gods, in merry mood, granted perpetual youth unto men, who, in their joy, thoughtlessly lay this gift of the gods upon the back of an ass, who being wonderfully pressed with thirst, and near a fountain, was told by a Serpent (which had the custody thereof) that he should not drink unless he would promise to give him the burthen that was on his back. The silly ass accepted the condition, and so the restoration of youth (sold for a draught of water,) passed from men to Serpents. This is fanciful and ingenious: it is part of the legend of Prometheus, which, says Eirionnach, is a confused account of an early tradition relative to the Fall of Man, and his forfeiture of immortality.

In the old English divines, Bishop Taylor, Hales of Eton, Farindon, &c. we meet with frequent allusions to this, as in the passage: "The true Christian not only kills the viper, but like the skilful apothecary, makes antidote and treacle of him." Serpents' flesh, too, we read in Pliny, was applied externally as a treacle or antidote to their bite.

Kæmpfer says the Japanese soldiers eat the flesh of the Serpent called *Fitakutz*, "believing firmly that it has the virtue of making them bold and courageous." The ancients tell of men having their sight and hearing restored or super-

naturally quickened by Serpents licking the organs. In Russia the flesh of a Serpent is esteemed a remedy for bad eyes.

The old receipts, eating Snakes as a charm for growing young, have puzzled many an inquirer. Fuller, in his *Holy State*, says: "A gentlewoman told an ancient batchelour, who looked very young, that she thought *he had eaten a snake.* 'No, mistress,' (said he,) 'it is because I never meddled with any snakes which maketh me look so young.'" Massinger, in his play of *Old Lady*, says:

> He hath left off o' late to feed on snakes;
> His beard's turned white again.

And the same dramatist, in his *Elder Brother:*

> He is your loving brother, sir, and will tell nobody
> But all he meets, that you have eat a snake,
> And are grown young, &c.

In Madame de Sevigné's *Letters*, we have an order for ten dozen vipers, two to be taken every day in stuffing a fowl; and directions for packing the aforesaid vipers. M. Keysler relates that Sir Kenelm Digby used to diet his beautiful wife (Venetia Stanley,) upon capons fattened with the flesh of vipers.

There is a prevalent belief in Northamptonshire, that a Snake can never die till the sun is down; cut or hack it as you will, it will never die till sunset. The idea has evidently its source in the amazing vitality common to the species. The same superstition prevails in Somerset, Cornwall, and Devon. But there is a still more wonderful story of the latter county. Near Totnes, two coast-guardsmen, in crossing a field, fell in with a Snake; one of them, an Irishman,

threw his jacket over the animal, and immediately uttered or muttered a charm over it: on taking up the garment, a few seconds after, the snake was dead!

In the *Secrets of Art and Nature*, 1661, we read that "Some physicians, with some confectiones made of a viper and hellebore, and of some of the flesh of the creature, do promise to restore youth, and *sometimes they do it.*" In the same page we are told, "it is known that stags renew their age by eating Serpents."

Our old herbals abound with accounts of plants as antidotes to the bite of Serpents, and those of the worst kind: this would lead us to suspect that such animals were formerly common in England, did we not know these old herbals were compiled almost entirely from the writings of the ancients, and from foreign sources.

Pliny tells us that a decoction from the leaves of the ash-tree, given as a drink, is such a remedy that nothing so soverraigne can be found against the poison of serpents;" and further, "That a serpent dare not come neare the shaddow of that tree. The serpent will chuse rather to goe into the fire than to flie from it to the leaves of the ash. A wonderful goodness of Dame Nature, that the ash doth bloome and flourish alwaies before that serpents come abroad, and never sheddeth leaves, but continueth green until they be retired into their holes, and hidden within the ground." Loskiel corroborates Pliny as to the ash being an antidote. Pliny also gives a receipt for making the famous *theriacum*, or treacle, of vipers' flesh.

Among the old remedies for the bite of the Rattlesnake is the following from Loskiel's account of the Moravian Missions to the North American Indians, who, he tells us, are remark-

ably skilled in curing the bite of venomous Serpents, and have found a medicine peculiarly adapted to the bite of each species. For example, the leaf of the Rattlesnake root is the most efficacious remedy against the bite of this dreadful animal. God has mercifully granted it to grow in the greatest plenty in all parts most infested by the Rattlesnake. It is very remarkable that this herb acquires its greatest perfection just at the time when the bite of these Serpents is the most dangerous. * * * Virginian Snake-root chewed, makes also an excellent poultice for wounds of this sort. * * * The fat of the Serpent itself, rubbed into the wound, is thought to be efficacious. The flesh of the Rattlesnake, dried and boiled to a broth, is said to be more nourishing than that of the viper, and of service in consumptions. Their gall is likewise used as medicine."

Pigs are excepted from the dreadful effects of their bite; they will even attack and eat them. It is said that, if a Rattlesnake is irritated and cannot be revenged, it bites itself, and dies in a few hours; but this is much controverted.

In Central and South America grows the *guaco*, a species of willow, which has proved an efficacious antidote to the bites of venomous reptiles. It flourishes in the hot regions, and is not found in the colder uplands: in their disposal, Nature again beautifully exhibits her design, for here exist not the venomous creatures. An infusion of guaco-leaves may be taken as a preventive or cure; or chewing the leaves is stated to be sufficient to enable a person to handle the most dangerous Serpents with impunity. In Australia, common fern steeped in spirits, is a well-known remedy for Snake-bites.

Besides being used medicinally, and as a charm, some

nations employ Serpents as an article of food. The American Indians, according to Hector St. John, feast on the Rattlesnake. The Chinese eat Watersnakes. The Doba of Abyssinia greatly esteem the flesh of Serpents, as the natives of Surinam do that of the boa. Bruce says: he saw "a man at Cairo take a live Cerastes, and beginning at the tail, eat it as one would do a carrot, or a stock of celery, without any seeming repugnance."

Cox, in his *Adventures on the Columbia River*, tells us that he has seen Canadians eat Rattlesnakes: "Their flesh is very white, and they assured me had a delicious taste. * * * Great caution, however, is required in killing a Snake for eating; for, if the first blow fails, or only partially stuns him, he instantly bites himself in different parts of the body, which thereby become poisoned, and would prove fatal to any person who should partake of it."

Dr. Fordyce knew the black servant of an Indian merchant in Africa, who was fond of soup made of Rattlesnakes, in which he always boiled the head along with the rest of the animal, without any regard to the poison.

M. Guyon has made several observations on the Sting of Reptiles, both in the West Indies and in Algeria. It is thought, but erroneously, to be more powerful in summer than in winter; but, one Drake, an exhibitor of Snakes, at Rouen, in the winter of 1827, handled a Rattlesnake which he took to be dead, while it was only benumbed by cold; he was bitten by it, and died in the course of nine hours. Dr. Guyon concludes the intensity, or power of the venom to be less owing to difference of season than to the length of time it has been accumulating in the reservoir of the reptile; this occurs in winter, because the animal is then in a torpid state.

Dr. Guyon had a Horned Viper, given him at the caravanserai of Sidi Makhlouf, Algeria. The reptile had been put into a bottle, which had since remained hermetically closed. It had been in there for six weeks without food and without air, and looked quite dead, since it could not stir in the bottle, which it filled entirely. Yet, on opening the bottle, the Doctor found the Viper perfectly sound, and saw it kill a large fowl instantaneously with its sting. In another case, a Scorpion that had been kept in a bottle for a long time, on being released, killed two sparrows in less than a minute, and a pigeon in three hours. M. Guyon has proved, by twelve years' experiments, that the venom of vipers is not poison to themselves; this explains why venomous reptiles are so numerous in some parts of the globe, as they are not naturally prolific: they cannot poison each other.

Ceylon is noted for its venomous Serpents. The Pimberah, or Rocksnake, is the largest of the tribe known, and belongs to the new genus *Python* of Cuvier. In size, it never exceeds 30 feet; it has a couple of sharp horny spurs, a short distance from the extremity of its tail, which are useful to the creature in climbing trees, and in holding fast its prey. Its colour is generally a mixture of brown and yellow; the back and sides are handsomely marked with irregular patches of dark brown, with very dark margins. The jaws are powerful, capable of great dilatation; and they are armed with large, strong, sharp teeth, reclining backward. As the muscular strength of this Snake is immense, and its activity and courage considerable, it may be credited that it will occasionally attack man. "There can be no doubt," says Davy, "that it overpowers deer, and swallows them entire." "The body of this creature," says Knox, "is as

big as a man's middle, and its length proportionable. It is not swift, but by subtlety catches its prey. It lies in the path where the deer pass, and as they go, clasps hold of them by a kind of peg that grows on its tail, with which it strikes them. It will swallow a roebuck whole, horns and all, so that sometimes the horns run through its belly, and kill it. A stag was caught by one of these Pimberahs, which seized him, and held him so fast, that he could not get away. An Indian seeing the stag, supposed him in a snare, and having a gun, shot him, at which he gave so strong a jerk, that it pulled the serpent's head off, while his tail was encompassing a tree, to hold the stag the better."

The first among the poisonous Snakes known in Ceylon is the Cobra di Capello of the Portuguese, the Hooded Snake of the English, the Noya of the Cingalese, and the Coluber naja of Linnæus. It is from 3 to 6 feet in length, and varying in colour, from light to dark brown. The natives, in general, rather venerate this snake than dread it. They conceive that it belongs to another world, and that when it appears in this, it comes merely as a visitor. They imagine that it possesses great power, being somewhat akin to the gods, and greatly superior to man: hence they superstitiously refrain from killing it, and always avoid it, if possible. Its bite is not so immediately fatal as is commonly supposed; fowls have been known to live two days after being bitten, though they frequently die within half an hour. This is the snake which the jugglers exhibit. Their dexterity in managing it is such that they easily excite it to the most desperate rage, and by a certain circular motion of the arms, appease it as readily. It is remarkable that the Cobra has an extreme reluctance to put into operation its deadly

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P. L.

power: it never bites, unless excited by actual injury, or extreme provocation; and even then, before it darts upon its aggressor, it always gives him timely notice of his danger, not to be mistaken. It dilates the crest upon its neck, which is a large flexible membrane, having upon the upper surface two black circular spots, like a pair of spectacles; it waves its head to and fro, the eye sparkling with intense lustre, and commences a hiss so loud as to be heard at a considerable distance; so that the juggler has always warning of his danger. The snake never bites while the hood is closed, and as long as this is not erected, it may be approached and handled with impunity. Even when the hood is spread, while the creature continues silent, there is no danger. Its fearful hiss is at once the signal of peril. Though the Cobra is so deadly when under excitement, it is, nevertheless, astonishing to see how readily it is appeased, even in the highest state of exasperation, and this merely by the droning music with which its exhibitors seem to charm it. It appears to be fascinated by the discordant sounds that issue from their pipes and tomtoms. The bite of the Cobra is much less fatal than is generally represented.

The Cingalese Tic polonga is the most dangerous in the island; but, fortunately, it is very scarce. The natives have great dread of it. It is from 4 to 5 feet long, and very thick in proportion to its length. It is very averse to exercise its deadly powers: it lies coiled up, and when irritated much, darts suddenly forward, and strikes with precision that seldom fails of producing fatal consequences. Dr. Davy, from several experiments, found its poison much more suddenly fatal than that of any other snake in India: fowls that were bitten, died within two minutes, and some within one; a rat expired

within a few seconds after it was bitten, the poison causing convulsions. Bishop Heber had a young Ticpolonga between 3 and 4 feet long, which would not attack unless irritated.

It is astonishing, that where snakes and other poisonous reptiles are supposed to abound, not only in Ceylon, but in India generally, so few accidents should occur: indeed, their infrequency is a strong presumptive proof that the snakes are much less numerous than is commonly supposed.*

In the *Oriental Annual* for 1835, is engraved from one of Daniell's masterly pictures, a fearful scene with a Boa Constrictor, in the Delta of the Ganges, called the Sunderbunds, nearly a hundred miles below Calcutta. The captain of a country ship, while passing here, sent a boat into one of the creeks, to obtain some fresh fruits. Having reached the shore, the crew moored the boat under a bank, and left one of the party to take care of her. During their absence, the Lascar who remained in charge of the boat, overcome by heat, lay down under the seats, and fell asleep. Whilst he was in this happy state of unconsciousness, an enormous Boa Constrictor, emerged from the jungle, reached the boat, had already coiled its huge body round the sleeper, and was in the very act of crushing him to death, when his companions fortunately returned at this auspicious moment, and attacking the Serpent, severed a portion of his tail, which so disabled him that he no longer retained the power of doing mischief. The Snake was then easily dispatched, and found to measure 62 feet and some inches in length. The writer of the account adds, the immense size of Boas has been frequently called in question, though it is well authenticated. Nor was it unknown to the ancients. Suetonius, in his Lives of the

* The Rev. Hobart Caunter, B.D.

Twelve Cæsars, mentions that the Emperor Augustus gave animals for exhibition; and amongst these a rhinoceros, a tiger, and a snake 75 feet long.

The Indian Snake-charmers have been long celebrated for their extraordinary dexterity, and by the natives generally, are supposed to have intercourse with demons. They are the most common class among the jugglers, and by far the most harmless: they infest the villages and fairs, exhibiting their snakes, and accompanying their movements with music, if that may be so called, from which all melody is banished. They carry their serpents in round wicker baskets, with flat bottoms, in which the creatures lie, coiled up in a state of lethargy, until roused by the harsh tones of their keepers' flutes. It is astonishing to see how they are affected by the tones of these rude instruments; for no sooner do their charmers begin to blow, than the snakes raise their heads, gradually erect themselves, waving their necks to and fro, as if in a state of ecstasy. The Hooded Snake is always the foremost: his bite is generally fatal; nevertheless, the charmers do not extract the poisonous fangs, as is commonly supposed, but exhibit these reptiles with all their powers of mischief unimpaired. The jugglers perform numberless tricks with these Snakes, although they are venomous. They always pretend that the fangs are extracted, in order to prevent alarm in those to whom they are exhibited. The general opinion of these pretenders is that they have the power of charming all venomous snakes, and of commanding their perfect obedience. The medium of communication they profess to be the musical instrument, the sound of which appears to infuse into the dumb captives new life and energy. "The same art," says the Abbé Dubois, "seems to have been laid

claim to in other ancient nations: witness the allegory of the Prophet, where he compares the hardened obstinacy of a sinner to a serpent that shuts its ear against "the voice of the charmer." The allegory here referred to is contained in the 4th and 5th verses of Psalm lviii.: "Their poison is like the poison of a serpent: they are like the deaf adder that stoppeth her ear; which will not hearken to the voice of charmers, charming never so wisely."

Strange stories are told of the guardianship of famous places by large Serpents; as in the case of the Gardens of the Hesperides, the golden apples in which were guarded by a terrible dragon which never slept. Turner has painted a magnificent picture of the Hesperides, which, it is now generally thought, were one of the Canary Isles, and the golden fruit oranges. We remember to have read of a large Serpent which infested, for a long time, one of the loveliest gardens in Bombay, and terrified visitors from partaking of its luxuriance. The Serpent's reign of terror was long: he was watched, and occasionally seen in stealthy enjoyment of the garden, but none durst attack him: at length, in a terrible onslaught, he was dispatched, and to the owners of the estate was restored the enjoyment of the elysium of the European quarter.

The Rattlesnake, from its fatal poison, has been laboriously studied by naturalists. Dr. Burnett, of the Boston Natural History Society, by the dissection of two large Rattlesnakes, has proved that they shed their fangs in use with the poison-sacs at their base, when they are old and worn; for directly behind these, the mucous membrane on each side is crowded with the *fangs of reserve*, in different stages of development, and generally replaced in six weeks. Dr. Burnett considers

there is good reason to believe that the action of the poison of the Rattlesnake is the same upon all living things, vegetable or animal; and that *it is just as fatal to the snake itself as to other animals*, for a specimen which had accidentally struck one of its fangs into its own body, was seen to roll over and die. "Here then," says Dr. Burnett, "we have the remarkable and perhaps unique physiological fact, of a liquid secreted directly from the blood, which proves deadly when introduced into the very source (the blood,) from which it was derived!" A few drops of chloroform being let fall upon the head of a snake, the sound of his rattle gradually died away, and in a few minutes he was wholly under the effect of this agent. A small quantity of his poison being presented to some human blood, under the microscope, the corpuscules ceased to run and pile together, and the effect was exactly as in death by lightning. The most full and complete antidote to the poison is alcohol: two quarts of brandy given to a person bitten in three hours, afforded relief, but without the least intoxication.

The popular belief that the number of *rattles* on the tail of the snake indicates its age, is erroneous; for it not only loses the rattles by accident, but two and even four rattles have been known to form in a single year.

Captain Marryat, the novelist, one of whose characteristics was to make the best of everything in life, observes that although the poison of the Rattlesnake is so fatal, it is, in fact, not a very dangerous animal, and people are seldom bitten by it. This arises from two causes: first, that it invariably gives you notice of its presence by its rattle; and secondly, that it always coils itself up like a watch-spring before it strikes, and then darts forward only about its own

length. Where Rattlesnakes are common, as in Wisconsin, persons generally carry with them a vial of ammonia, which, if instantly applied to the bite, will at least prevent death.

Captain Drayson, in his *Sporting Scenes among the Kafirs of South Africa*, describes an adventure with a Boa Constrictor, in which he learnt how the Boa destroys animals. The teeth of Boa Constrictors being long, bent, and turned back, something in a fish-hook shape, the snakes dart out and seize hold of their prey. Then drawing their heads back again, they pull the animal to the ground at once, and coiling round it, commence the crushing process. This power of squeezing must be enormous. On attempting to skin this animal, the muscles inside had the appearance of strings of rope extending from the head to the tail; these he seemed to have the power of contracting or extending, so that a part that might be three feet long as he coiled himself round your body, could be instantly reduced to about a foot by this means with great crushing power. The Boa is not poisonous, and a man with a sharp knife, and his arms free, could soon kill the serpent; but, once coiled round the man's body, the danger would be great. Captain Drayson saw an old man near the Umbile River pin a large Boa Constrictor to the ground, with several assagaies stuck into its body: the snake had killed a calf some time before: he had long watched to catch out of his hole the snake, and having done so, after a few yards' race, he dispatched it.

When a menagerie of animals was kept at the Tower of London, Mr. Cops, the Keeper, one day, while offering a fowl to one of the Boas, had nearly met with a serious accident; the snake, which was almost blind, from the approaching change of its skin, missed the fowl, and seizing the keeper's

thumb instead, around which and its own head it instantaneously threw two coils; and then, as if surprised at the unexpected resistance, cast an additional fold round his neck, and fixed itself by its tail to one of the posts of its cage in such a manner as nearly to throttle him! His own exertions, however, aided by those of the under-keepers, at length disengaged him from his perilous situation; but so determined was the attack of the snake, that it could not be compelled to relinquish its hold until two of its teeth had been broken off and left in the thumb.

The Philippine Islands swarm with venomous snakes, the bite of which often proves fatal: one of the most poisonous is only from fifteen to twenty inches long. Captain Stedman had a strange encounter at Surinam with a serpent, which being made fast to a strong forked bough, a negro stripped off its skin as he descended: this was a young snake twenty-two feet in length.

In the United Service Museum, Whitehall, is preserved a fine specimen of a Boa, 19½ feet long, which Sir Robert Ker Porter sent from the city of Caracas: in Venezuela it is called "Water-serpent," and "Deer Swallower." The natives will not bathe in the lakes and rivers in which it lurks, and feeds upon fish, and animals which come there to drink. The flesh of this serpent is white; the people of the plains never eat it, but use its fat as a remedy for rheumatic pains, strains, &c.

The enormous Serpent of the great Desert of Sahara, though not venomous, is scarcely on that account less destructive: it grows from 20 to 80 feet long. The Arabs figuratively say it fires the ground with the velocity of its motion: it will twist itself round an ox, and after crushing its bones, will

swallow it gradually, and then lie on the ground till the animal be digested. Two of these Serpents stationed themselves on the road from Morocco to Terodant, near the latter city: one was killed, the other remained there several days, and prevented travellers passing the road.

Mr. Waterton, in his *Wanderings in South America*, had many snake adventures, in which his resources and courage were strongly shown. One day, during the absence of his Indian servant, he tells us, "I observed a young Coulacamara, ten feet long, slowly moving onwards; I saw he was not thick enough to break my arm, in case he got twisted round it. There was not a moment to be lost. I laid hold of his tail with the left hand, one knee being on the ground; with the right hand I took off my hat, and held it as you would hold a shield for defence. The snake instantly turned, and came on at me with his head about a yard from the ground, as if to ask me, what business I had to take liberties with his tail. I let him come hissing and open-mouthed, within two feet of my face; and then, with all the force I was master of, I drove my fist, shielded by my hat, full in his jaws. He was stunned and confounded by the blow, and ere he could recover himself, I had seized his throat with both hands, in such a position, that he could not bite me; I then allowed him to coil himself round my body, and marched off with him as my lawful prize. He pressed me hard, but not alarmingly so." When Mr. Waterton's servant returned, great was his trepidation at the company his master had got into: so, he turned about, and ran off home: the sight of the snake had positively turned him sick.

The Rev. Lansdown Guilding thus records the capability of the Boa to cross the seas: "A noble specimen was con-

veyed to us by the currents twisted round the trunk of a large sound cedar-tree, which had probably been washed out of the bank by the floods of some great South American river, while its huge folds hung on the branches, as it waited for its pery. Its skeleton now hangs before me in my study."

In 1864, there were described to the Boston Society of Natural History, in the United States, two Serpents, each with two heads. One was a young Black Snake, which had two complete heads united to a single trunk. The second was a Water Adder, in which the heads were more widely separated than in the preceding one, each head being supported by a distinct neck; the tail was also double for about an inch: the most remarkable deviation was found near the middle of the body, where the vertebral column was double, and provided with a double set of ribs, but was single before and behind it. Serpents, in which the head is double, have been often noticed. Aristotle mentions such. Redi found one alive, sunning himself on the banks of the Arno, near Pisa: the heads were of equal size, each supported by a neck. Redi preserved it alive for several weeks and made experiments with it: he noticed that the right head died seven hours before the left.

That Ireland was infested with venomous reptiles before St. Patrick's time, that he banished them, and that "*serpents* cannot survive in Ireland," is a well-known tradition, and one universally received amongst the native Irish. In Christian symbolism it was usual to designate sin or Paganism by a serpent or dragon, and saints who converted heathen nations, or subdued the heathen promptings of their own nature, were represented with a serpent or dragon beneath

their feet. Thus, St. Patrick, by preaching the doctrine of the Cross, and uprooting Paganism, may be said to have banished venomous serpents from Ireland. In his case, however, the symbol may have had a deeper meaning, if, as many, and with great probability, think, *Serpent Worship* formed part of that Oriental heathenism which obtained in early times in Ireland.

Solinus, who flourished at the close of the second century, notices the strange fact of Ireland's having an immunity from reptiles; Isidore and Bede, in the seventh and eighth centuries, respectively repeat the assertion. Jocceline of Furnes, Sir James Ware, Fynes Morison, and several others, notice the absence of serpents in Ireland. Some cases of introducing reptiles into Ireland are recorded. About 1797, a gentleman is said to have imported from England into Wexford, a number of vipers, who died immediately after; but, it is recorded that in 1831, six Snakes, (*Coluber natrix*, Linnæus,) were purchased in Covent Garden Market, and turned out in the garden of Rath Gael House: four were killed shortly afterwards, as were, most probably, the two others, for the country-people offered a considerable reward for their destruction. Yet, though the Snake is not indigenous to Ireland, there is nothing in either the soil or climate to prevent its naturalization. It is highly probable that an insular position is unfavourable to the spread of the serpent tribe. Other islands, as well as Ireland,—New Zealand, for instance, have no native *Ophidia*. (W. Pinkerton; *Notes and Queries*, iv. 12).

The Maltese declare that St. Paul, after his shipwreck, cured all the venomous reptiles of Malta, and banished them for ever, just as St. Patrick is said to have afterwards

treated those of his favourite isle. Whatever be the cause, the fact is alleged by travellers to be certain, that there are no venomous animals in Malta: Brydone was assured that vipers have been brought from Sicily and died almost immediately on their arrival.*

Ireland's freedom from reptiles did not escape the notice of Julius Solinus, in his *Polyhistoriæ*, at the close of the first century after Christ: he writes, "Illis, (*i.e.* Hibernia,) *nulla anguis.*" The story, therefore, of St. Patrick's triumph, in so far as it related to a literal serpent, must be now abandoned as a myth.*

It will be remembered that there are no Snakes in Ireland; for frail must be the memory of that reader who having read Horrebow's *Natural History of Ireland*, (from the Danish,) "Chap. lxxii. Concerning Snakes. There are no Snakes to be met with throughout the whole island," which is the entire chapter.

The great constricting Serpents of the Old World have been named by M. Douadin, Pythons. Their size is equal to that of the Boa. The Great Python of the Sunda Isles grows to 30 feet in length, and stout in proportion, and is able to manage a buffalo. Daniell has painted a fine picture of a man seized by one of these great Serpents. The story goes that a Malay prow was anchored for the night under the island of Celebes. One of the crew had gone on shore to search for betel-nut, and is supposed to have fallen asleep upon the beach from weariness on his return. In the dead of the night his companions on board were roused by dreadful screams: they immediately went ashore, but they came too late, the cries had ceased, and the wretched man had breathed

* Eirionnach; Notes and Queries, vi. 147, 590.

his last, crushed in the folds of an enormous Serpent, which they killed. They cut off the head of the Snake, and carried it, together with the lifeless body of their comrade, to the vessel.

The Zoological Society's collection of Serpents, in the Regent's Park, contains some remarkably fine specimens, including a large male and female Python, who, one day, in 1862, extruded 100 eggs, but the incubation failed.

In the autumn of 1852, one of the Zoological Society's Keepers lost his life from the bite of a Cobra, in the Serpent-house; the only mark on the body was a slight discolouration on the bridge of the nose.

Serpents have formidable enemies, in great number, among animals. Man kills them, whether they be venomous or inoffensive, wherever he detects them. All the countries of the globe produce certain animals that pursue Serpents. With us it is chiefly the badger, the hedgehog, the weasel, the marten, and the polecat, that contribute to the destruction of Serpents. In the tropical countries of the old continent they encounter terrible enemies in the civet, the ichneumon, and other carnivorous quadrupeds. Several birds wage on them a continual war: such, especially, is the serpent-eater of the Cape, mounted on its long, stilt-like legs, as it would seem on purpose to render the bites of Snakes ineffectual. In South America, the laughing falcon, and other birds of prey, pursue them eagerly. The large storks of India destroy an immense number of Serpents. In Europe, we should reckon among their enemies, besides the storks, ravens, kites, and several buzzards. In tropical seas there exist sharks that devour with avidity the water-serpents; and, lastly, many ophidians make war on each other, not even

sparing their own species. By transplanting animals, the enemies of Serpents, into countries infested by them, we might, perhaps, prevent the too great multiplication of these dangerous reptiles. This attempt has been made by transporting the Secretary Bird of the Cape to the French West Indian sugar-colonies.

This Bird, which is a most formidable enemy to reptiles, is about to be naturalized in France, for which purpose specimens have been forwarded to the Acclimatisation Garden in Paris by the French Vice-Consul at Port Elizabeth, Cape Colony. By its organization, this bird is wonderfully adapted to its office, having robust limbs and claws, a piercing eye, and a very strong beak, by which it destroys large numbers of reptiles, even the most venomous. On this account it is protected by law, and fostered by the people at large, almost every house in the neighbourhood of Cape Town having a pair of Secretary Birds domesticated. Its introduction into some departments of France infested with vipers, into Cayenne, the Mauritius, and Algeria, will doubtless be highly beneficial.

Several species of intestinal worms infest the viscera of Serpents, some in such numbers as to cause death. Some few are attached to their skins, and suck their juices. Schlegel, who has written an able work on the Physiology of Serpents, has detached parasites from pythons, and several Javanese species. Serpents, however, it must be remembered, are useful in destroying hurtful animals, such as the small gnawers, worms, insects, and molluscs, which they pursue.

VII.

ELECTRIC FISHES, THEIR HISTORY AND APPLICATION.

IN this age of *instantaneous transmission* and electric triumph, everything appertaining to its phenomena and their history has a living interest for the thoughtful reader. Yet, the information we possess upon the subject is mostly of modern date. True it is that some four-and-twenty centuries ago, the roving old bachelor, Thales, whilst strolling along the sea-shore, may have picked up a piece of umber, and from it produced what he believed to be the first electric power. But the word *electricity* is little more than two hundred and fifty years old; and our oldest electrical instrument is apparently an invention of less than two hundred years since. Yet the power is as old as the Creation; and a living electric fish was the earliest, and is still the most familiar, electric instrument employed by mankind.

In 1856, Professor Simpson, of Edinburgh, drew attention to the application of the living Torpedo as a remedy by the ancient Greek and Roman physicians, in proof of the antiquity of the practice of employing electricity in medicine. Although the historians of Electricity have not overlooked the fact, that the ancients were aware of the electrical powers of the Torpedo, they passed unnoticed the employment of the fish. Priestley, in his *History and Present State of Electricity*, 1775, refers to

the Gymnotus as "possessed of a kind of natural electricity, but different from the common electricity, in that persons who touch it in water are shocked and stunned by it, so as to be in danger of drowning;" and Priestley then asks, "whether the sensation communicated by the Torpedo does not depend upon a similar electricity?" No historical importance is attached to these references. This is the more remarkable, that when Priestley wrote, the only electrical power known to characterize the fishes which he names was that of giving the "shock;" and so marvellous did this phenomenon appear to him, that he goes the extreme length of declaring, that "the electric shock itself, if it be considered attentively, will appear almost as surprising as any discovery that Sir Isaac Newton made." Historians, since Priestley, have not failed to quote the classical reference to the Torpedo, but have attached no importance to its medical use; and no Natural Philosopher, as far as Professor George Wilson was aware, has ever hinted the claim of the electric fishes to rank first in order of time among electrical instruments.*

The fishes which have been or are thus employed are limited to different species of the Torpedo, the Gymnotus, and the Silurus or Malapterurus; the first a widely-distributed marine genus, the second abounding in many of the rivers of South America, and the third in certain rivers of Africa. Of none of these fishes but the Gymnotus can it with certainty be affirmed, that those who made use of them were aware that they were electrical instruments; and in the case of the Gymnotus this remark only applies to its medical use in very

* "On the Electric Fishes as the Earliest Electric Machine employed by Mankind." Read to the Natural History Section of the British Association, 1857.

recent times, though there is reason to believe that it had been employed for centuries by the South American savages as a mysterious heroic remedy.

The antiquity of the practice rests chiefly on the case of the Torpedo, as employed by the civilized dwellers on the shores of the Mediterranean. From their writings we can trace the practice back for nearly two thousand years; certainly to before the Christian era. Dr. Badham, in his learned and amusing volume, *Fish Tattle*, speaks of the marvellous powers of the Torpedo, "which long before the Leyden phials were invented, or the principles of electricity understood, had pressed this redoubtable agent into its service, and was wont to give practical lessons to all who did not object to the 'charge.'" The peculiar powers of this fish are referred to or commemorated at length by a whole host of ancient writers. Plato compares Socrates to a Narké, from that sage's well-known capabilities of electrifying his auditory; and its achievements have been described by Aristotle, Cicero, Plutarch, Pliny, Oppian, Ælian, Athenæus, and Galen. So far as medical use is concerned, Dr. Badham observes that "the electric properties of this enchantress of the sea suggested to ancient practitioners to try its efficacy in the cure of headache, and painful nervous affections, by applying it epidermically; and Dr. Galen, who seems to have been a strong homœopathist, advises the numb-fish (which he erroneously supposes to retain some electrical virtue after death and stewing), as a dish to paralytic patients, with a view to cure their numbness; no doubt on the *similia similibus* principle."

Whether Galen held the theory which Dr. Badham, half in jest, half in earnest, attributed to him, it is interesting to notice that the term Torpedo (happily translated numb-fish),

implies that the Roman physicians were more struck by the ultimate paralysing effect of the Torpedo's discharge than by the earlier convulsing one. As the ancients were familiar with the shock, we may say that the Torpedo was for them, as for us, a living electric shock-machine. The title is a distinctive one, applicable only to a few creatures, all scaleless inhabitants of the waters, developing electricity, great in quantity, high in intensity; and admitting, as the creature wills, of being retained latent, or set free with killing force. These fishes thus correspond to our artificial medicinal electric instruments, such as the coil-machine, in the quantity and quality of the electricity they furnish; but differ from them in this important particular, that we cannot compel them to give a shock any more than we can compel a leech to bite or to suck blood. So much are we at the mercy of their will in this matter, that, in the case of the Torpedo, Badham, speaking of himself, says, "We were not able, during a long sojourn at Naples, to obtain one shock in our person; while many lazzarone friends, (who did not seek it,) had frequently their arms 'astonished' for a whole day, after lugging a narké on board." How far the ancients realized this fact, of which to some extent they must have been cognisant, and what devices they followed to induce the Torpedo to give its shock, does not appear very clearly from the Greek and Roman writings which have come down to us; but as they and other ancient practitioners ascribe similar properties to the dead as to the living Torpedo, it may be inferred that they were fully aware of the purely voluntary nature of the electric discharge.

These few references will sufficiently illustrate the electrical practice of the ancient physicians. Asclepiades, who flourished in the first century, B.C. employed the Torpedo in inflammation,

and as a stupefacient. Anterus, a freed man of Tiberius, was successfully treated for gout through the application of a live Torpedo. Pliny, in the first century, cites the Torpedo as a manifestation of the mighty powers of nature. "From a considerable distance even, and if only touched with the end of a spear or staff, this fish has the property of benumbing even the most vigorous arm, and of riveting the feet of the runner, however swift he may be in the race. If, upon considering this, we find ourselves compelled to admit that there is in existence a certain power which, by the very exhalations, and, as it were, emanations therefrom, is enabled to affect the members of the human body, what are we not to hope for from the remedial influences which Nature has centred in all animated beings."*

Paulinus Ægineta (end of the sixth or beginning of the seventh century), who continued to be looked up to as one of the highest authorities in medicine and surgery during a long succession of ages, thus condenses the opinions of his predecessors:—"Torpedo: when applied to the head, *while still alive*, in cases of headache, it procures relief to the pain, probably by its own peculiar property of producing torpor; and the oil in which the *living* animal has been boiled, when rubbed in, allays the most violent pains of the joints." Dr. Francis Adams, who translates the above, refers to the general employment of the Torpedo by the Greek, Roman, and Arabian physicians, adding the significant query—"Is not this an application of the principle of galvanism in medicine?"

Marcellus prescribes standing on a live black Torpedo, on a moist shore, which has been washed by the sea, till torpor

* Natural History, Book XXXII. chap. ii.

is felt through the feet up to the knee, as a certain cure for gout. In the treatment of severe and obstinate headache, the Torpedo was laid on the aching head, and left there till it had thoroughly benumbed it. The fish was probably wetted occasionally with sea-water, or immersed in it, otherwise it must soon have ceased to be "*torpedo viva;*" but, whether dead or alive, its good effects must frequently have been owing as much to its acting as a cold poultice or wet bandage, as to its efficiency as an electric machine. It was faith, however, in its electric power, that led to its medicinal use. It is probable that the ancient physicians borrowed their torpedinal remedy from the Mediterranean fishermen long after they had acquired faith in it; and, altogether, we may safely say, in round numbers, that the electrical machine, as embodied in the Torpedo, is at least two thousand years old. It is, probably, very much older, for barbaric nations love what the French call "heroic" remedies; and the shock of the provoked Torpedo is likely to have been held medicinal by the earliest fishermen of the Mediterranean Sea. It would be interesting to ascertain whether the Italian sailors of the present day have any traditional respect for the Torpedo as a mediciner. It is sold in the Neapolitan markets as an article of food, but it is doubtful whether Galen's successors agree with him in imparting to it medicinal virtues after it is cooked.

Another electric fish besides the Torpedo was known to the civilized nations of antiquity, and to nations whose civilization is of much earlier date than that of the Greeks and Romans. The Nile breeds one, if not more electrical fishes; and when we remember what an imaginative, intelligent people the ancient Egyptians were, and that both their medica'

skill and their practice of animal worship were likely to interest them in the singular endowments of the electric fish, we may well expect to find its power chronicled, if not employed, by their priests and physicians. Yet, nothing has been extracted from either the hieroglyphics or the paintings on tombs, to fulfil this expectation; and the absence of pictorial representations of the Nile fish from the Egyptian monuments has been adduced as a proof of the special esteem with which it was regarded. "It might reasonably be expected," says Sir Gardner Wilkinson, "that the *raad*, or electric fish of the Nile, would be one of the most sacred, and forbidden for food; and it seems not to be represented among those caught in the ancient fishing scenes:" he adds, "it is a small fish, and the one I saw measured little more than a foot long by four inches in depth, but it had the power of giving a very strong shock. It is the *Melapterurus electricus*, and may have been the ancient *Latus*."*

Thus far Egyptian antiquity is silent as to the very existence of an electric fish; but the name by which the Melapterurus is known to the modern Egyptians has been referred to as proving that their predecessors had more or less precisely ascertained that the same force which is present in the thunder-cloud is present in the shock-giving fish. If this view is well founded, it is difficult to say how remote the period is to which we must carry back the commencement of electrical science, if not electrical art. Wilkinson says, "The name *raad* ('thunder') is very remarkable, since the modern Egyptians are quite ignorant of its peculiar powers; and if it was borrowed by them from their predecessors, the question naturally arises, Were they acquainted with elec-

* Popular Account of the Egyptians, vol. ii. p. 192.

tricity?" As the word *raad*, however, is Arabic, its origin, though ancient, may be much later than the latest of the Pharaohs. Assuming, as it should seem, this view, Alexander Von Humboldt asks, "Did an ingenious and lively people, the Arabians, guess from remote antiquity that the same force which inflames the vault of heaven in storms is the living and invisible weapon of inhabitants of the waters? It is said that the electric fish of the Nile bears a name in Egypt that signifies thunder." It might be pleaded in behalf of this view that the sagacious Arabian physician, Averrhad, explicitly affirmed of the Torpedo, as Dr. Badham notices, that "the power which this fish possesses of affecting the skin, seems to be of a kind analogous to that by which the magnet acts upon steel," and would have extended this explanation to the Silurus. But, does the word *raad* really signify thunder-fish? Humboldt replies in the negative, adding that a distinction is to be made "between *rahd*, thunder, and *rahadh*, the electrical fish; and that this latter means simply that which causes trembling."

The modern name of the Nile electric fish thus does not justify the conclusion that the Egyptians, of past or present times, believed that the shock of the fish was the same in nature as a lightning-shock. A name exactly equivalent in meaning is given, as Humboldt incidentally informs us, to the Gymnotus as well as the Torpedo, by the South American Spaniards, "who confound all electric fishes under the name of *trembladores*, literally 'tremblers,' or 'producers of trembling.'" At the present day, the Silurus of the Nile is sold in the markets of Cairo, and used as food.

We have now to consider the extent or generality of using electrical fishes as *shock-machines*. Anciently, the Torpedo

was probably employed medicinally on all the shores of the Roman empire, including our own, which it visited; though Professor Wilson cannot find any traces of its use more precise than in the shock-giving powers implied in its vernacular titles, such as the Maltese "name of *Haddayla*, a term which has reference to, its benumbing powers;" the French one, *La Tremble*, and the English, specially expressive names, *cramp*-fish and *numb*-fish.

One modern people, however, makes use of the Torpedo exactly as the ancients did, though whether as a tradition from the Mediterranean electro-physicians, or as an independent discovery, is not certain. The Abyssinians, Dr. Badham tells us, employ the Torpedo, (presumed from the Red Sea,) in the treatment of fever: "the patient is first strapped to a table, and the numb-fish then applied successively over every organ of the body: the operation is reported to be both very painful and very successful." It is, however, likely that the Torpedo is still employed on many shores.

The identity of the living power which the Torpedo possesses, with that which is called into action from inert matter, and which we call electricity, has been established to perfection; and the direction of the current of force determined by the united and successive labours of Walsh, Cavendish, Galvani, Humboldt, and Gay-Lussac; Todd, Sir Humphry Davy, Becquerel, and Matteucci. The latter has shown that when the Torpedo is very excitable, the current may be compared to that of a pile consisting of a great number of pairs charged with a good conductive active liquid; whilst, on the other hand, when its liveliness is weak the electric current resembles that of a pile composed

of a small number of elements. Matteucci was the first who had the idea of employing Faraday's apparatus of the extra current for obtaining the spark from the Torpedo. In this he succeeded by placing the Torpedo upon an isolated plate of metal, and placing another plate of metal above it, then fixing to each of them a gold leaf separated by the distance of half a millimetre. By slightly moving the upper metallic plate, the animal became irritated; at the same moment the two leaves approached one another, and the report of the spark was instantly heard.

Matteucci has established the unequal power of different parts of the brain in the production of shocks: thus, the hemispheres of the cerebrum may be touched, wounded, and even removed, without a discharge taking place, while the cerebellum cannot be touched without producing a discharge; the effect is still produced, sometimes even after the death of the animal, and when this part is removed, all discharge ceases.

Next to the Torpedo, the Gymnotus is the most famous among electrical fishes, and it is by far the most powerful: the shock, indeed, of a large Gymnotus is so severe, that no lover of heroic remedies, having one at command, need long for a magneto-electric coil machine. Several species, or varieties of the fish occur, as Humboldt tells us, in the large rivers of South America, the Orinoco, the Amazon, and the Meta, besides frequenting their tributaries. They have accordingly been familiar for centuries to the Indians, who are constantly reminded of their presence even in rivers too deep to let them be caught or frequently seen, by the shocks which they feel when bathing or swimming in these waters. The shallower streams, also, and

basins of stagnant water, near the sources of the Orinoco and elsewhere are, in Humboldt's words, "filled with electrical eels," so that their shock-giving powers are forced upon the attention of all visiting those districts; and we cannot but feel curious to know whether any medicinal use has ever been made of living machines so powerful. At first sight it might appear that their very power had prevented their use. Humboldt mentions that "the dread of the shocks caused by the Gymnoti is so great, and so exaggerated among the common people, that during three days, we could not obtain one, though they are easily caught, and we had promised the Indians two piastres for every strong, vigorous fish." He mentions a stream, the Gymnoti in which had killed so many mules every year, that it was found necessary to divert the road passing through it.

However, Humboldt prevailed upon the Indians to undertake to procure him some Gymnoti, when they proposed to *fish for them with thirty wild horses*, which they brought from the savannah, and drove into the pool. The electric eels rose from the mud, and like so many large snakes, swam to the surface of the water, when, crowding under the bellies of the horses and the mules, the struggle between animals of very different organization began. The Indians, furnished with harpoons and long slender rods, closely surrounded the pool; while others climbed the trees stretching over the waters, and, with their wild cries and long rods, prevented the horses from coming to the edge of the basin. The eels defended themselves by repeated discharges of their electrical batteries, and for some time seemed likely to gain the victory. Several horses sunk under the invisible blows; and benumbed by the force and

frequency of the shocks, disappeared. Others, panting, their manes erect, and their haggard eyes expressive of anguish, endeavoured to escape from the electric storm, but were driven back by the Indians. A few, however, gained the shore, and there stretched themselves on the sand benumbed to exhaustion with the shocks they had received. In less than five minutes, two horses were killed: the Eel, five feet in length, pressed itself against the belly of the horse, and made a discharge along the whole extent of its electric organ, attacking at once the heart, the viscera, and the abdominal nerves: the horses, probably, were not killed, but only stunned; but were drowned from the impossibility of rising amidst the prolonged struggle between the other horses and eels. The latter, at length, dispersed, and approached the edge of the pool, where five of them were taken by means of small harpoons fastened to long cords, and a few more were caught towards evening, by which was procured a sufficient number for Humboldt's experiments. This graphic account has been often quoted, but is too illustrative to be omitted here, in the above abridged form.

"It would be temerity," says Humboldt, "to expose ourselves to the first shocks of a very large and strongly-irritated Gymnotus. If by chance a stroke be received before the fish is wounded or wearied by long pursuit, the pain and numbness are so violent that it is impossible to describe the nature of the feeling they excite. I do not remember ever having received from the discharge of a large Leyden jar a more dreadful shock than that which I experienced by imprudently placing both my feet on a Gymnotus just taken out of the water. I was affected, during the rest of the

day, with a violent pain in the knees, and in almost every joint. To be aware of the difference that exists between the sensation produced by the voltaic battery and an electric fish, the latter should be touched when in a state of extreme weakness. The Gymnoti and the Torpedos then cause a twitching of the muscles, which is propagated from the part that rests on the electric organs, as far as the elbow. We seem to feel at every stroke an internal vibration, which lasts two or three seconds, and is followed by a painful numbness."

Notwithstanding the experience of the Indians, it did not keep them from employing the shock-giving power of the Gymnotus in medicine. "In Dutch Guiana, at Demerara, for instance, electric eels were formerly employed to cure paralytic affections. At a time when the physicians of Europe had great confidence in the effects of electricity, a surgeon of Essequibo, named Vander Lott, published in Holland a Treatise on the Medicinal Properties of the Gymnotus. These electric remedies are practised among the savages of America, as they were among the Greeks." Here we have plainly a record of the Indian use of the Gymnotus in medicine as a device of the Americans, not an imitation of European practice. It appears further, that the Spaniards had not taught this practice to the Indians, or borrowed it from them. "I did not," observes Humboldt, "hear of this mode of treatment in the *Spanish* colonies which I visited; and I can assert that, after having made experiments during four hours successively with Gymnoti, M. Bonpland and myself felt till the next day a debility in the muscles, a pain in the joints, and a general uneasiness, the effect of a strong irritation of the nervous system."

On this point it remains to state, that even in Europe, the Gymnotus was used as an electric machine in the end of the last century. One sent from Surinam to Stockholm lived more than four months in a state of perfect health. Persons afflicted with rheumatism came to touch it in hopes of being cured. They took it at once by the neck and tail; the shocks were in this case stronger than when touched with one hand only. It almost entirely lost its electrical power a short time before its death. In this case, the Gymnotus was known to yield electricity by those who employed it; but the practice was probably borrowed from the aborigines of its native country. At all events it is quite certain that, alike without knowledge of artificial electrical machines, or acquaintance with the medicinal uses to which the Greeks and Romans put the Torpedo, the wild Indian doctors had already made trial of the healing electric virtues of the living Gymnotus.

We must now say a few words as to *the Gymnotus in England.* This animal seems, in certain respects, better adapted for investigation than the Torpedo; especially in its power of confinement, and capacity of being preserved alive and in health for a long period. To obtain Gymnoti, therefore, became a matter of consequence; and in 1835, Faraday was favoured by Humboldt with considerable aid and advice for procuring some of these fishes. Meanwhile, a Gymnotus was brought to this country, and purchased by the proprietors of the Gallery in Adelaide Street, Strand. Faraday thus described the new comer. The Gymnotus, or Electric Eel, had a large bull-head, with a long tapering body, underneath which were beautiful fringes, or abdominal fins. By these is obviated the tortuous progress, such as that of the

common eel, and the movements of the Gymnotus are rendered exceedingly graceful. The essential organs of this creature, those requisite for vital functions, are situated immediately behind the head, and are very small in proportion to the *electrical organs.* The latter occupy the whole remaining length, and consist of four separate organs, composed of matter different from any other in the body of the fish. The nerves that lead from the brain and spinal marrow to the electrical organs, are numerous in comparison with those which supply the fluid or force, or influence necessary for vitality. They may be cut through, and thus the electrical organs separated from the vital parts; when the creature will still live and flourish, and become even more lively than when in its natural state; and when it may be said to be inconvenienced by the large demand of the organs for the nervous fluid, or "the something" which is doubtless used, worked up in them to produce electrical effects.

The Gymnotus at the Adelaide Gallery was forty inches long; it had lost one eye; next to its graceful movements was admired the richness of its covering, which, in appearance, resembled the plush then recently introduced for waistcoats, the colour being an admixture of dark puce and brown. This eel was caught about March, 1838, but did not feed from that time till the 19th of October. On its arrival at the Gallery, it was in a very debilitated state; it was placed in an apartment heated to 77°; and acting upon Humboldt's directions, boiled meat, cut small, was put into the water for its food; but the animal would touch neither meat, nor worms, small frogs, fish, nor bread, which were all tried in succession. The plan adopted by the London fishmongers for fattening the common eel—that of

putting bullock's-blood into the water in which it was kept—was then tried, and the Gymnotus gradually improved in health. By the 19th of October it killed and ate four small fish, gudgeons, carp, and perch, one a-day. The Gymnotus was kept in a tub, in warm water, and thus it lived for some time.

In feeding the animal, a remarkable result of the relation of the Gymnotus and its prey to the medium around them, was, that the larger the fish to be killed or stunned, the greater would be the shock to which it was subject, though the Gymnotus might exert only an equal power; for the fish had passing through its body those currents of electricity, which, in the case of a smaller one, would have been conveyed harmless by the water at its side.

When Professor Faraday first experimented with the Gymnotus, it was apparently languid, but gave strong shocks on the hands being placed, one on the body near the head, and the other near the tail; when the nearer the hands were together, within certain limits, the less powerful was the shock. Next, Professor Faraday, in the presence of Professors Daniell and Wheatstone, and others, succeeded in obtaining from the eel the electric spark; and one of the party who had the temerity to grasp the creature with both hands, had his curiosity satisfied with a shock, which, if he were before incredulous, must have effectually removed all doubts as to the electric properties of the animal; and the electricity was so intense as to be communicated by simply immersing the hands in the vessel of water containing the eel.

A very beautiful experiment was made by Mr. Gassiot, by which attractions of gold-leaves were manifested; this being, Mr. Gassiot believed, the first instance on record of such an

effect from animal electricity. Attraction was evidenced with an electroscope made of an inverted glass tumbler, having two small holes drilled in the opposite sides, through which passed two wires, with brass balls attached: to each ball was fixed a gold leaf, placed parallel to each other, and as close as the eye could observe, or about 1-30th to 1-40th of an inch apart; and, on contact with the eel being made, they were not only attracted with considerable force, but were actually fused, scintillating in the most beautiful manner.

This Gymnotus died in March, 1842, after affording our *savans* several opportunities of experimenting with its powers.

In experiments made at Naples by MM. de Miranda and Paci, with a Gymnotus brought from Rio Janeiro, in 1844, the animal was placed in a large metal trough filled with water; its food consisted of frogs and small fish. When it wished to eat a frog, it directed itself towards it, and at the distance of a foot, stopped and looked at it. The frog became motionless, or paralyzed, when the Gymnotus seized it, and devoured it. The Gymnotus would not always seize the frog nearest to it, and sometimes would kill it without feeding upon it, which seemed to indicate that the only object the eel had in view was to discharge its electricity. It attained the length of three feet four inches: the largest Gymnoti that Humboldt observed in South America were five feet three inches.

The Gymnotus at Naples did not make the shock every time it was touched: sometimes it was necessary to irritate the animal, and get men to squeeze it, especially near the electric organ,—a fact, which proves that its electrical apparatus is not put in action except by the concurrence of its own will. Sometimes, when it was irritated, the shocks that it gave

were so energetic that they surpassed those of the strongest piles, and they who received them felt their effects for a considerable time: they were more intense before the animal's meal than when it had eaten. Two persons who were suffering with rheumatism, after receiving a few shocks from this Gymnotus were entirely restored.

The present experimenters frequently obtained with the needle deviations of more than 90°, which could not be measured by the multiplying apparatus; the needle deviated briskly as if it had received a mechanical blow, and the action was so intense as to render the needle unfit for other experiments. To obtain the deviation it was not necessary to put the conductors into contact with the eel, but it was enough to plunge them into the water, even at several inches distance from the Gymnotus, to obtain a considerable deviation at the moment of discharge.

We have now to deal with a new Electric Fish, a new species of Malapterurus, which has been found in the muddy brackish water of the River Old Calabar, near Creek Town; and as the river empties itself into the Bight of Benin, the fish has been named the *Malapterurus Beninensis*. Four living specimens were sent to Edinburgh, where Professor Wilson observed their shock-giving powers. The shock was a sharp one, felt from the fingers to the wrist, the elbow, or the shoulder, according to the activity of the animal, and the position in regard to it of the hands of the experimenter. The fish varies in length from two to twelve inches, is sluggish in its general movements, but retentive of vitality and electrical energy even in unfavourable circumstances: it is powerfully endowed with the electric faculty, in this respect differing from the Nile species, which is weak in

comparison with the Gymnotus. A small specimen of this new fish, about 2 inches in length, gave the Rev. Mr. Waddell, of Creek Town, a shock which reached his shoulder; he kept one fish for six weeks in a tumbler of water, and it gave severe shocks daily. Mr. W. C. Thomson, who was stationed for several years at Creek Town, learnt that the electric properties of the fish are there made use of by the natives as a cure for their sick children. The fish is put into a dish containing water, and the child made to play with it; or the child is put in a tub or other vessel with water, and one or more of the fish put in beside it. "It is interesting to find that a remedy which has only of recent years come into favour among ourselves should have been already anticipated by the unlettered savage, who, probably, has had the remedy handed down to him by tradition from remote generations." *

The wife of the Rev. W. Anderson, who brought the living fishes from Old Calabar, testifies that the native mothers generally keep one of the fishes in a large basin, and that on washing their infants in the morning, the practice is to dip either the hands or feet of the child, so as to cause it to receive a shock. This is done, they say, for the purpose of *strengthening* the child; the strong and the healthy have to undergo the operation as well as the weak and sickly. And that the fish is not an inactive agent in this singular process may be safely inferred from what follows:—"So far as Mrs. Anderson's observation goes, there is no liking for the affair on the child's part; plenty of struggling and squalling. The natives use the fish as food."

* See an interesting Account of this Fish, by Mr. Murray; Edinburgh Philosophical Journal, October, 1855.

Mr. J. R. Wylie, a teacher at Creek Town, says:—"The Calabar women use this fish in the following manner; they put one or two, according to size, in a tub of water, and then wash the infants in the tub with the fish and all. They must have a strong sense of the benefit derived from this, as in general they dislike doing anything which makes their infants cry; and this process makes them do so most lustily. They also make the children drink a great quantity of the water in which the fish have been. I have been in yards, and seen, on several occasions, the process described." The attributing remedial virtues to the water in which the fish has been kept, is a fact of interest when taken in connexion with the similar opinion entertained by the Greeks, according to Ælian, in reference to the water in which a torpedo had lain.

Mr. Thomson mentions one instance of the electric power which fell under his own notice. He had a tame heron which had been taken when young, and had never had an opportunity of fishing for itself. On one occasion, some live fish were brought in, and among them was a small *Malapterurus*. The bird swallowed it, but had no sooner done so than it gave a loud scream, and was thrown down with violence: it got up again, and soon recovered, but would never after touch a *Malapterurus*.

Mr. Wylie gives the native name of the malapturus as "Ryak eke odumade owo," "*Fish which bites man, or Electric Fish.*" The Rev. Mr. Anderson enters more into detail: "The native name of the Electric fish is Edidem or Edidim. Edidem is the word for *king*, or rather *emperor*." The word *dum* means *to bite;* and if the fish be called edidum or edidim, then the meaning is *the biter*, or *the biting*. The meaning of the name is however uncertain.

We have thus triple testimony that the employment of the malapterurus as a remedial electric machine is an established practice among the natives of Old Calabar, and it may be inferred that the practice is one of great antiquity among them. "It thus appears," says Professor Wilson, "that the nations bordering the Mediterranean, the Abyssinians, the Indians of South America, and the dwellers on the western rivers of Africa, have independently used the torpedo, the gymnotus, and the malapterurus as living shock machines. The practice certainly dates from before the Christian era, so far as the first-named fish is concerned, and in all probability is of much earlier date for all the electric fishes.

Two conclusions, accordingly, seem to be established; namely, 1st, That the oldest electrical machine employed by mankind was the living electric fish: 2nd, That the electrical machine most familiar to mankind is also the electric fish. In all probability we are as yet ignorant how many such fishes there are, and not less ignorant of the light in which many of those known to exist are regarded by the nations familiar with them.

There is likewise reason to believe, from the statements of Humboldt and others, that undescribed varieties of the Gymnotus occur in South American rivers. Dr. Barth saw at Yo, on the north shore of Lake Tsad, "a specimen of the electric fish, about ten inches long, and very fat, which was able to numb the arm of a man for several minutes." And Dr. Baillie has met with an electric fish in Fernando Po, which Sir John Richardson believed to be identical with the malapterurus of Old Calabar. The natives call this "the Tremble-fish;" and Sir John Richardson understood this

word, or rather its African equivalent, to be of native origin, and not a translation from any European language; this, however, is not quite certain.

To return to the Torpedo and Gymnotus, whose economy has been more completely studied and illustrated than the electricity of other fishes. The delicate experiments of Matteucci on the Torpedo agree with those made by our own Faraday upon the Gymnotus, in proving that the shocks communicated by those fishes are due to electric currents generated by peculiar electric organs, which owe their most immediate and powerful stimulus to the action of the nerves In both species of fishes, the electricity generated by the actions of their peculiar organized batteries—besides its benumbing and stunning effects on living animals—renders the needle magnetic, decomposes chemical compounds, emits the spark, and in short, exercises all the other known powers of the ordinary electricity developed in organic matter, or by the artificial apparatus of the laboratory.

"It is notorious," says Professor Wilson, "that the electric fishes of various genera have been kept for weeks, or even months, along with other fish, without exerting their fatal electric powers upon them. In the case of the Torpedo, indeed, and perhaps also of the Silurus or Malapterurus, these powers are probably serviceable chiefly as means of defence. It is otherwise with the Gymnotus, which systematically kills its prey by electric discharges. Its immense batteries, however, are much more powerful than is requisite for the slaughter of the small fish on which it lives, and are largely employed by it as offensive and defensive weapons. It appears, indeed, to be a most pugnacious creature." *

* Note to Prof. Wilson's contribution in the Edinburgh Philosophical

Humboldt calculates that each square league of the Plains of Caracas contains two or three ponds filled with Gymnoti.

Sir John Richardson states there to be not less than eleven genera of fishes known that have the power of giving electric shocks. There is one peculiarity in all these fishes, namely, the absence of scales. In every one of them has been discovered an apparatus which consists of a series of galvanic cells, put in action by a powerful system of nerves.*

In the last century, some Gymnoti were brought alive to England, and exhibited to the Royal Society, after one of their Club feasts. Wray, writing of a Club-meeting in 1776, says that "after a capital dinner of venison, which was absolutely perfect, we went to another sumptuous entertainment, at the Society, where *five electrical eels, all alive,* from Surinam, were exhibited, most of the company receiving the electrical stroke; and then we were treated with the sight of a sucking alligator, very lively."

Journal; to which valuable work we are indebted for some of the leading facts of this paper.

* See Things not generally Known, p. 199.

VIII.

LIFE OF THE GORILLA.

THIS truly extraordinary animal—a great anthropoid ape,—whose existence had scarcely been credited since the days of Herodotus, appears to have been discovered in Africa, by the missionary, Dr. Savage, in the year 1847. The country of the animal—"the Gorilla Region," as it is called, is presumed to be Western Lybia, described by Herodotus, as "extremely mountainous, covered with jungle, and full of wild beasts. Here are to be found enormous snakes, lions, elephants, bears, apes, and horned asses; also dog-headed apes, and some without heads, but having eyes in their breasts, according to the Lybians." Now, considering that Herodotus was writing from hearsay derived from barbarians, whose inaccurate ideas and descriptions had to be translated in his own tongue as well might be, it has been asked, May we not see in the "dog-headed" and "headless" apes of the historian the gorillas and high-shouldered baboons of the present time?

Various evidences of the Gorilla—skulls, skeletons, and finally entire animals—have successively reached the Museums of Paris and London; and with those sent to Boston, U.S., have been described by the professors of zoology and comparative anatomy in those cities. The differences in the results of the observations by the American, French, and English

naturalists are chiefly as follows. Dr. Wyman agrees with Professor Owen in referring the Gorilla to the same genus as the Chimpanzee, but differs from him in regarding the Chimpanzee as being more nearly allied to the human kind. Professor Duvernoy and Geoffrey St. Hilaire enter the animal in the Zoological catalogue as *Gorillagina*, the specific name being that by which the beast is known and dreaded by the natives of Gaboon, in Western Africa. The French naturalists also concur with the American in placing the Gorilla below the Chimpanzee in the Zoological scale, and some have even been disposed to place both below the hylobates, or long-armed apes.

Reverting to the ancient notices which may relate to this great anthropoid ape of Africa, this singular creature seems to have been known, even by name, to the ancients more than five hundred years before the Christian era, according to Dr. Falconer's *Translation of the Voyage of Hanno*, (London, 1797,) with his Dissertation vindicating the authenticity of the *Periplus*. The following is the translation, by Bishop Maltby, of the passage supposed to allude to the species in question. Hanno, having penetrated as far as the fifth degree of north latitude, according to Bougainville's Map, states: "On the third day, having sailed from thence, passing the Streams of Fire, we came to a bay called the Horn of the South. In the recess there was an island like the first, having a lake, and in this there was another island full of wild men. But much the greater part of them were females, with hairy bodies, whom the interpreters called '*Gorillas*.' But pursuing them, we were not able to take the males; they all escaped, being able to climb the precipices, and defended themselves with pieces of rock. But three females, who bit

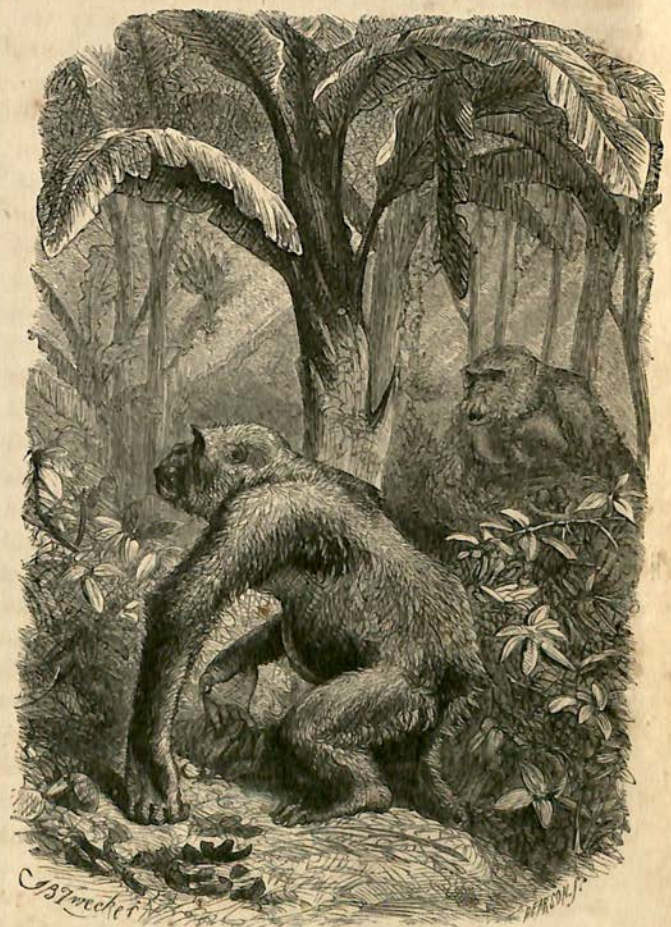
and scratched those who led them, were not willing to follow. However, having killed them, we flayed them, and conveyed the skins to Carthage. For we did not sail any further, as provisions began to fail." This encounter indicates, therefore, the southernmost point on the west coast of Africa reached by the Carthaginian navigator. Thus, the Museum of Carthage, (if such existed,) may have possessed three skins of the female Gorilla, brought home by Hanno, more than two thousand three hundred years before the British Museum was enriched by fine specimens of the animal.

Professor Owen considers that the size and form of the great ape, now called "Gorilla," would suggest to Hanno, and his crew no other idea of its nature than that of a kind of human being; but the climbing faculty, the hairy body, and the skinning of the dead specimens, strongly suggest that they were large anthropoid apes. The fact of such apes having the closest observed resemblance to the negro, being of human stature and with hairy bodies, still existing on the west coast of Africa, renders it highly probable that such were the creatures which Hanno saw captured, and called "Gorullai." A brief observation in Purchas's *Pilgrimage*, 1748, of the nature and habits of the large human-like ape which he calls "Pongo" more decidedly refers to the Gorilla. Cuvier, however, rejected all idea of the existence of any such ape; and it has only been authentically re-introduced since the intelligent attention of Dr. Savage to the skull, which he first saw at the Gaboon in 1847, and upon which he took Professor Owen's opinion.

'It has been stated to the Liverpool Literary and Philosophical Society, by Mr. Moore, that a young living Gorilla had been once in Liverpool, and was very tame and docile:

this specimen is now in the Waterton Museum, at Walton Hall. "The Land of the Gorilla" was explored by the adventurous M. du Chaillu between the years 1855 and 1861, and although the published results have been much impugned, to him science stands indebted for no less than sixteen well-preserved specimens of the Gorilla; his collection of animals from Africa is now in the British Museum, and his book of "Explorations and Adventures" is, to a certain extent, accredited for the information it contains of the habits of the curious creature; and Du Chaillu himself has given *vivâ voce* evidence in reply to the cross-examination of several conflicting naturalists.

Du Chaillu has heard from the natives strange stories of the animal: one told how, some years previously, a party of Gorillas was found in a cane-field, tying up the sugar-cane in regular bundles, preparatory to carrying it away. The natives attacked them, but were routed, while others were carried off prisoners by the Gorillas; but in a few days they returned home uninjured, with this horrid exception—the nails of their fingers and toes had been torn off by their captors. Several spoke up, and mentioned names of men now dead whose spirits were known to be dwelling in Gorillas. Finally was rehearsed the story which is current among all the tribes who at all know the Gorilla, that this animal lies in wait in the lower branches of trees, watching for persons who go to and fro, and when one passes sufficiently near, grasps the luckless fellow with his powerful feet, and draws him up into the tree, where he quietly chokes him. Of course, these are but tales told to travellers. Yet, Du Chaillu, nothing daunted, flew at his game, and here is his own description of the first Gorilla he shot:



P. 204.

THE GORILLA AT HOME.

"Suddenly, as we were yet creeping along, in a silence which made a heavy breath seem loud and distinct, the woods were at once filled with the tremendous barking of the Gorilla. Then the underbush swayed rapidly just ahead, and presently before us stood an immense male Gorilla. He had gone through the jungle on his all-fours, but when he saw our party he erected himself and looked us boldly in the face. He stood about a dozen yards from us, and was a sight I think I shall never forget. Nearly six feet high (he proved four inches shorter), with immense body, huge chest, and great muscular arms, with fiercely-glaring large deep grey eyes, and a fiendish expression of face, which seemed to me like some nightmare vision: thus stood before us this king of the African forest. He was not afraid of us. He stood there, and beat his breast with his huge fists till it resounded like an immense brass-drum, which is their mode of offering defiance, meantime giving vent to roar after roar. The roar of the Gorilla is the most singular and awful noise heard in these African woods. It begins with a sharp *bark* like an angry dog, then glides into a deep bass roll, which literally and closely resembles the roll of distant thunder along the sky, for which I have sometimes been tempted to take it where I did not see the animal. So deep is it that it seems to proceed less from the mouth and throat than from the deep chest and vast paunch. His eyes began to flash fiercer fire as we stood motionless on the defensive, and the crest of short hair which stands on his forehead began to twitch rapidly up and down, while his powerful fangs were shown as he again sent forth a thunderous roar. And now truly he reminded me of nothing but some fiendish dream creature—a being of that hideous order, half-man half-beast, which we

find pictured by old artists in some representations of the infernal regions. He advanced a few steps—then stopped to utter that hideous roar again—advanced again, and finally stopped when at a distance of about six yards from us. And here, just as he began another of his roars, beating his breast in rage, we fired, and killed him. With a groan which had something terribly human in it, and yet was full of brutishness, he fell forward on his face. The body shook convulsively for a few minutes, the limbs moved about in a struggling way, and then all was quiet; death had done its work, and I had leisure to examine the huge body. It proved to be five feet eight inches high, and the muscular development of the arms and breast showed what immense strength it had possessed."

This was encouraging success. In other Gorilla hunts, the warfare was extremely dangerous. The creature only haunts the darkest parts of the forests, where even at mid-day one can scarce see ten yards. Du Chaillu relates a terrific encounter which his man Gambo had with a stalwart Gorilla: the forest resounded with awful roars, amidst which poor Gambo strayed away, and was found by his master apparently dead; when he came to himself he said that he had met a huge male Gorilla, face to face, and that it did not attempt to escape. It was very savage; in a very gloomy part of the wood, Gambo fired at the creature only eight yards off; the ball merely wounded it in the side; it beat its breasts, and with great rage, advanced upon Gambo, who stood his ground, and reloaded his gun; just as he raised it to fire the Gorilla dashed it out of his hands, the gun going off in the fall; and then, in an instant, and with a terrible roar, the animal gave him a tremendous blow with his immense paw, frightfully

lacerating the abdomen. As he sank bleeding to the ground, the monster seized the gun, and the poor hunter thought his brains would be dashed out with it. But the Gorilla seemed to look upon the gun also as its enemy, and in its rage, almost flattened the barrel between its strong jaws.

Du Chaillu succeeded in obtaining young Gorillas alive, but, after occasioning great trouble, as well as excitement in the encampment, each specimen died, not so much from hunger, for they ate freely, but apparently from the confinement of a cage.

Prof. Owen has described the skins of the adult male and female of the young of the Gorilla, in Du Chaillu's collection. The adult male strikes one as a more bestial or brutish animal than the Chimpanzee; all the features relating to the wielding of the strong jaws and large canine teeth are exaggerated; there appears to be less brain—its case is more masked by strong intermuscular crests. The prevalent colours are grey and fuscous brown, in various alternations, and varying depths of tint. The scanty hair of the cheeks and chin is dark; the pigment of the naked skin of the face is black. The breast is almost naked, and the hair is worn short or partially rubbed off across the back, in consequence of the habit ascribed by Du Chaillu to the great male Gorilla of keeping at the foot of a tree, resting its back against the trunk. The skin of the great male Gorilla, as mounted in the British Museum, exhibits two opposite wounds,—the smaller in front on the left side of the chest, the larger close to the lower part of the right blade-bone. Two of the ribs in the skeleton of this animal are broken on the right side near where the charge had passed through the skin in its course outwards. These marks correspond with the account of the slaughter of

the great Gorilla given by M. du Chaillu. The young male Gorilla has a well-dressed "skull-cap" of reddish-coloured hair. The dentition in the youngest specimen corresponds with that of the human child; but, later, the Gorilla differs, like the Chimpanzee and the Orangs, from the human order of dental development and succession. Professor Owen states that we have no evidence of a taller Gorilla than one 4 feet 5 inches in height: "It is the body of a giant placed upon the legs of a dwarf." The ridges over the sunken eyes are very prominent, and as the animal comes at one, he raises the bristles by which they are surmounted, and presents a perfectly fiendish aspect. From the enormous canines, their habits might be thought to be carnivorous, but after close study, they are believed to be strictly vegetarian. They are solitary rather than gregarious, living mostly in pairs, and sometimes in families of not more than five; the young ones generally as soon as they are old enough taking wives to themselves.

The foot is very peculiar: the whole sole is wider than in man—much wider in proportion to its length—more like a hand, but one of huge dimensions, with a stupendous power of grasp. It corresponds with what the negroes of the Gaboon narrate—that the Gorilla letting down its hind hand from its leafy concealment, upon an unsuspecting passer-by, grasps him round the neck, draws him up with ease, and having strangled the negro in his unrelaxing grasp, drops him a corpse! The negroes dread the Gorilla's strength and tusks much more than the lion, and regard the huge ape as their sole truly formidable enemy during their expeditions in quest of ivory in the trackless forests. Yet the creature is evidently, by the structure of the grinding teeth, frugivorus.

Among the fabulous stories is that of its building houses,

which is impossible. Each Gorilla requires not less than a barrel of food a-day, a quantity which, in its dense forests, necessitates the animal being constantly on the search. Some travellers tell of thousands of these apes being congregated in the forest recesses, where it would be impossible for any such number to find subsistence. It was formerly believed, that they lived in trees; but it is as Professor Owen predicted, from their structure—these heavier apes are more generally on the ground, seeking for nuts.

M. du Chaillu, in reply to inquiries by the *savans* of the British Association, has stated that the Gorilla was exceedingly strong in the arm. A Gorilla once broke the ribs of a servant of his, who died in consequence. He had frequently seen them snap branches of hardwood two inches in diameter. If a man once got into the arms of a Gorilla it was not very likely he would get away again. He had no doubt one blow from a Gorilla would break a man's arm. The Gorilla walks with the utmost difficulty, in consequence of the shortness of its legs.

The paramount interest attached to the Gorilla led many persons unhesitatingly to believe that the Gorilla was the original of man. Professor Owen has enumerated several points of difference in the construction of the respective species: besides, there is the great distinction of speech—the only noise the Gorilla is known to make is a loud shriek. With respect to the general distinctions, M. du Chaillu himself says that during his residence among the tribes found in the mountains near the banks of the Ovenga river, where the Gorilla is more common than elsewhere, he searched in vain for an intermediate race, or rather several intermediate races or links between the natives and the Gorilla; but he (M. du

Chaillu,) found not a single being, young or old, who could show an intermediate link between man and the Gorilla, which would certainly be found if man had come from the ape. I suppose (adds Du Chaillu,) from these facts, we must come to the conclusion that *man belongs to a distinct family from that of the ape.*"

Du Chaillu confidently states the young of the Gorilla to be untameable; in reply to which Mr. R. B. Walker, of the Gaboon, reminds Du Chaillu of the young female Gorilla, from 2 to 3 years of age, called Seraphine, which lived at his (Walker's) factory for four months in 1859. Scores of Europeans saw this animal, which was perfectly tame, docile, and tractable; far more so, indeed, than many Negro children of the same age. Not only was she on good terms with all grown-up persons in and about the factory, but was exceedingly attached to her keeper, and accompanied him about the factory, and in his walks about the town and neighbourhood. She was familiar and quiet with Mr. Walker and his clerks, and was only displeased when children approached her; and for these she seemed to have, in common with most large apes and monkeys, a very great dislike. She was seldom tied up, and even then only by a very small cord, which she could have broken, or cut with her teeth, had she been so inclined. She allowed herself to be clothed, seeming to like it; and actually went to breakfast with a friend of Mr. Walker's, and conducted herself to the admiration of all present.

Another important discovery in natural history, by M. du Chaillu is that of the Bald-headed Ape, Nescheigo M'bouvé, which builds a nest from 15 to 20 feet from the ground, in the branches of trees. These apes invariably choose trees "which stand apart from others, and which have no limbs

below the one on which the nest is placed;" and they perform their work so perfectly, that Du Chaillu could scarcely persuade himself that human hands had not built it. Yet, in spite of the perfection of their architecture, which is impervious to rain, these Apes do not occupy a nest more than eight or ten days, so that abandoned nests are as common in these forests as are deserted "pahs" in the backwoods of New Zealand. Du Chaillu has brought to light many other species, new to science, of bird, of beast, and of fish. Here we read of a nest-building fly, with a most diabolical sting, and there of a squirrel that feeds on tusks of ivory; here of an ape (Koolookamba) which, in head-piece at least, approaches nearer to man than does the Gorilla, and there of a carpentering bird, carving its nest out of a tree, and lining it with feathers.

IX.

REAL LIFE OF THE BEAVER.

THE old saying, "Man favours wonders," was never more completely exemplified than in the wonderful tales which have been told of the Beaver. It has been represented as an accomplished architect, gifted by Nature with a head to design, and instruments to execute well-planned houses containing chambers, each set apart for its appropriate purpose. The lovers of the marvellous, when they had once given the reins to their imagination, soon converted its tail into a sledge, or trowel, and astonished the world with an elaborate account of the mode in which the plaster was laid on with this, according to them, masonic implement: nay, they even turned it into an instrument of office. With it the overseers (such officers, according to the accounts given of their civil institutions, it was the custom of the community of Beavers to appoint,) were said to give the signal to the labourers whose employment they superintended, by slapping the tail on the surface of the water. All this, and more than this, has faded away before the light of truth. The houses of Beavers have sunk into rude huts, in the construction of which their tails are never used; their pile-driving, (for among other feats, they were said to drive stakes of the thickness of a man's leg three or four feet deep into the ground,) has turned out to be a mere fable; and their polity has proved to be

nothing more than a combination of individuals, such as we see among many of the inferior animals, impelled by an instinct common to all to perform a task in the benefit of which all participate.

But, after discarding all exaggerations, there remains enough to make the works actually carried on by these animals a subject of deep interest, as we shall presently see. First, we shall describe the Beaver. It is a rodent or gnawing animal, with two incisor or cutting teeth, and eight molars in each jaw, twenty in all. It is particularly distinguished from all the rest of its order, by a broad, horizontally flattened tail, which is nearly oval, and covered with scales. There are five toes on each of the feet, but those of the hinder ones only are webbed, the webs extending beyond the roots of the nails. The second toe of these last is furnished with a double nail, or rather with two, like those of the other toes; and another beneath it is situated obliquely with a sharp edge directed downwards. There is also a less perfect double nail on the inner toe of the hind feet.

The incisor teeth of the Beaver are broad, flattened, and protected by a coat of very hard orange-coloured enamel, the rest of the tooth being of a comparatively soft substance; in the former a cutting, chisel-like edge is obtained: indeed, no edge-tool, with all its combination of hard and soft metal, could answer the purpose better. In fact, the Beaver's incisor tooth is fashioned much upon the same principle as that followed by the tool-maker, who forms a cutting instrument by a skilful adaptation of hard and soft materials till he produces a good edge. But the natural instrument has one advantage over the artificial tool; for the former is so organized that, as fast as it is worn away by use, it is reproduced

from the base. So hard is the enamel, and so good a cutting instrument is the incisor tooth of the Beaver, that when fixed in a wooden handle, it was, according to Sir John Richardson, the naturalist and traveller, used by the Northern Indians to cut bone, and fashion their horn-tipped spears, till it was superseded by the introduction of iron, when the Beaver-tooth was supplanted by the English file. The power of these natural tools was witnessed by Lewis and Clarke, on the banks of the Missouri. "The ravages of the Beaver," say they, "are very apparent: in one place the timber was entirely prostrated for a space of three acres, in front of the river, and one in depth, and great part of it removed, although the trees were in large quantities, and some of them as thick as the body of a man." Sir John Richardson also says: "When the Beaver cuts down a tree, it gnaws it all round, cutting it, however, somewhat higher on the one side than on the other, by which the direction of its fall is determined. The stump is conical, and of such a height as a Beaver, sitting on its hind-quarters, could make." The largest tree this writer observed cut down by them was six or seven inches in diameter. By good authority it is also stated that a Beaver will lop off with his teeth, at a single effort a stem of the thickness of a common walking-stick, as cleanly as if done by a gardener's pruning-knife.

Hearne, the traveller, has truthfully described the habits of the American Beavers. The situation of their houses is various. They inhabit lakes, ponds, and rivers, and narrow creeks; but the two latter are generally chosen by them when the depth of water and other circumstances are suitable, so that they have then the advantage of a current to convey wood and other necessaries to their habitations; and because, in

general, they are more difficult to be taken than those that are built in standing water. They always choose those parts that have such a depth of water as will resist the frost in winter, and prevent it from freezing to the bottom. The Beavers that build their houses in small rivers, or creeks, in which water is liable to be drained off when the back supplies are dried up by the frost, are wonderfully taught by instinct to provide against that evil by making a dam quite across the river, at a convenient distance from their houses. The materials made use of in the Beaver-dams are drift-wood, green willows, birch, and poplars if they can be got; also, mud and stones so intermixed as must evidently contribute to the strength of the dam; but there is no other order or method observed in the dams, except that of the work being carried on within a regular sweep, and all the parts being made of equal strength. In places which have been long frequented by Beavers undisturbed, their dams, by frequent repairing, become a solid bank, capable of resisting great force, both of water and ice; and as the willow, poplar, and birch generally take root and shoot up, they by degrees form a kind of regularly planted hedge, which Hearne had seen in some places so tall that birds had built their nests among the branches.

The Beaver-houses are built of the same materials as their dams, and are always proportioned in size to the number of inhabitants, which seldom exceeds four old and six or eight young ones; though by chance Hearne had seen double that number. Their houses are of much ruder structure than their dams; for, notwithstanding the sagacity of these animals, it has never been observed that they aim at any other convenience in their houses than to have a dry place to lie

on ; and there they usually eat their victuals, which they occasionally take out of the water. Some of the large houses have one or more partitions, if they deserve that appellation, but it is no more than a part of the main building left by the sagacity of the Beaver to support the roof. These different apartments, as some call them, have no communication with each other but by water, so that they may be called double or treble houses. Hearne saw a large Beaver-house in a small island that had near a dozen apartments under one roof; and two or three excepted, they only had communication with each other by water. As there were Beavers enough to inhabit each apartment, it is more than probable that each family knew their own, and always entered at their own doors, and without any further connexion with their neighbours than a friendly intercourse, and joining their united labours in erecting their separate habitations, and building their dams where required. Travellers who assert that the Beavers have two doors to their houses, one on the land side and the other next the water, seem to be less acquainted with these animals than others who assign them an elegant suite of apartments. Such a construction would render their house of no use, either to protect them from their enemies, or guard them against the extreme cold of winter.

So far are the Beavers from driving stakes into the ground when building their houses, that they lay most of the wood crosswise, and nearly horizontal, and without any other order than that of leaving a hollow or cavity in the middle. When any unnecessary branches project inward, they cut them off with their teeth, and throw them in among the rest, to prevent the mud from falling through the roof. It is a mistaken

notion that the wood-work is first completed and then plastered; for the whole of their houses, as well as their dams, are, from the foundation, one mass of mud and wood mixed with stones, if they can be procured. The mud is always taken from the edge of the bank, or the bottom of the creek or pond near the door of the house; and though the Beaver's fore-paws are so small, yet it is held up close between them under the throat: thus they carry both mud and stones, while they always drag the wood with their teeth. All their work is executed in the night, and they are so expeditious that in the course of one night Hearne knew them to have collected some thousand of their little handfuls. It is a great piece of policy in these animals to cover the outside of their houses every fall with fresh mud, and as late as possible in the autumn, even when the frost becomes pretty severe, as by this means it soon freezes as hard as a stone, and prevents their common enemy, the Wolverene, from disturbing them during the winter. As they are frequently seen to walk over their work, and sometimes to give a flap with their tails, particularly when plunging into the water, this has given rise to the vulgar opinion that they used their tails as a trowel, with which they plaster their houses; whereas that flapping of the tail is no more than a habit which they always preserve, even when they become tame and domestic, and more particularly so when they are startled.

Their food consists of a large root, a kind of water-lily which grows at the bottom of lakes and rivers. They also eat the bark of poplar, birch, willow, and other trees; but as the ice prevents their getting to the land in the winter, they rely for food in that season upon such sticks as they cut down in summer, and throw into the water opposite the doors

of their houses. The roots are mostly their winter food; in summer they vary their diet by eating different kinds of herbage, and such berries as grow near their haunts. When the ice breaks up in the spring, the Beavers always leave their houses, and rove about until a little before the fall of the leaf, when they return to their old habitations, and lay in their winter stock of wood. When about to erect a new habitation, they begin felling the wood early in the summer, but seldom begin to build until the middle or latter end of August, and never complete it till the cold weather sets in.

When their houses are attacked, they retreat to holes in the river-banks, where they are generally captured. When the Beavers in a small river or creek are to be taken, the Indians sometimes stake the river across, to prevent them from passing; and then they search for their holes or places of retreat in the banks. Every man being furnished with an ice-chisel, lashes it to the end of a staff four or five feet long, and knocking it against the ice, he knows by its sound when he is opposite any of the Beavers' holes or vaults. As soon as he suspects any, he cuts a hole in the ice, big enough to admit an old Beaver. Meanwhile, others break open the Beaver's house, which, at times, is no easy task, for these houses are frequently five or six feet thick. Captain Cartwright describes in Labrador Beaver-dams one hundred feet long, over which he walked with the greatest safety. When the Beavers find that their habitations are invaded, they fly to their holes in the banks for shelter; and on being perceived by the Indians, which is easily done by attending to the motion of the water, they block up the entrance with stakes of wood, and then haul the Beaver out of its hole,

either by hand, or by a large hook at the end of a long stick. In this kind of hunting, every man has the sole right to all the Beavers caught by him in the holes or vaults; and each person takes care to mark such as he discovers by sticking up the branch of a tree, by which he may know them. All that are caught in the house are the property of the person who finds it. Beavers can keep under water a long time, so that when their houses are broken open, and all their places of retreat discovered, they have but one choice left, as it may be called, either to be taken in their house, or their vaults; they generally prefer the latter, for where there is one Beaver caught in the house, many thousands are taken in the banks. Sometimes they are caught in nets, and very frequently in traps.

Hearne kept several Beavers till they became so domesticated as to answer to their name, and follow those persons to whom they were accustomed, in the same manner as a dog would do. They were much pleased at being fondled: in cold weather they were kept in Hearne's own sitting-room, where they were the constant companions of the Indian women and children, and were so fond of their company that when the Indians were absent for any considerable time, the Beavers showed great signs of uneasiness; and on their return showed equal marks of pleasure by fondling on them, crawling into their laps, lying on their backs, sitting erect like a squirrel, and behaving like children who see their parents but seldom. During the winter, the Beavers mostly lived on the same food as the women did, and were remarkably fond of rice and plum-pudding; they would eat partridges and fresh venison very freely. Hearne never tried them with fish, though it is said they will at times prey on them.

The instinctive building labours of the Beaver are only fully displayed in communities; indeed, the animal loses its distinguishing qualities, the moment it becomes isolated from its fellows, and condemned to live in solitude: brought up together, Beavers will live in perfect harmony, and labour in concert; but removed from society, each lives for himself alone. M. F. Cuvier describes Canadian Beavers shut up in menageries, to strongly illustrate this observation: being taken very young, and brought up in a solitary manner, in narrow cages, they never habituate themselves to anything but obedience to their master's will; whenever an attempt is made to unite them, it is followed by violent combats, and severe wounds. Cuvier mentions an extremely mild Beaver, which was habituated to the presence of men, and would suffer itself to be touched, and carried in the hand: at last, it was brought to live familiarly with some dogs; for, it is worthy of remark, that certain animals of different species will sooner contract an affection for each other, when united by man, than those of the same species.

Major Rodefort, of New York, had a tame Beaver, which he kept in his house for a year and a half, and allowed to run about like a dog: and was fed with bread and fish. He dragged all the rags and soft materials he could lay hold of into a corner where he was accustomed to sleep, and there made a bed of them. The cat belonging to the house, having kittens, took possession of his bed, and he gallantly allowed her to remain there. In the absence of the cat, the Beaver would take one of the kittens between his paws, fondle it, and hold it to his breast, as if to warm the little animal, which, on the cat's return, he restored to her. Sometimes he grumbled, but never attempted to bite.

In the menagerie at Exeter Change, in the Strand, there were, in 1820, two Beavers, which were so tame as to allow themselves to be handled by the visitors. These Beavers wrestled and played together; they seemed much amused in dragging about any moveable, but in no instance were they observed to drag anything on their tails. They gnawed wood so voraciously, that had they been allowed the full range of a room, they would have eaten their way out, and thus have escaped.

Sir Hans Sloane kept a female Beaver in his garden at Chelsea, for nearly three months: she was about half-grown, and except her tail, very much resembled a great, overgrown water-rat. Her food was bread and water; she scarcely tasted willow-boughs given to her; but when loose in the garden, she gnawed vines as high as she could reach, down to the root; she also gnawed jessamine and even holly trees. When she ate, she sat on her hind legs, and held the bread in her paws, like a squirrel. She swam with her hind webbed feet only, steering with her tail; she would keep under water two or three minutes, and then came up to breathe; she swam much swifter than any water-fowl, and moved under water as quickly as a carp. She was very lively, and enjoyed a spring for a bath; she had one day convulsive fits, very like epilepsy in men, from which she soon recovered; she was, at length, killed by a dog.

Mr. Broderip, the well-known naturalist, had a pet American Beaver, the account of which is very interesting, inasmuch as the faculties displayed by the animal must, from its extreme youth, have proceeded from unassisted instinct. This individual arrived in England in the winter of 1825: he was very young, small, and woolly, and without

the covering of long hair which marks the full-grown Beaver. He was the sole survivor of five or six, which were shipped at the same time, and he was in a very pitiable condition. Good treatment quickly restored him to health, and kindness soon made him familiar. When called by his name, "Binney," he generally answered with a little cry, and came to his owner. The hearthrug was his favourite haunt, and thereon he would lie stretched out, always near his master.

The building instinct showed itself when he was let out of his cage and materials were placed in his way, and this before he had been a week in his new quarters. His strength, even before he was half-grown, was great. He would drag along a large sweeping-brush, or a warming-pan, grasping the handle with his teeth, so that the load came over his shoulder, and he advanced in an oblique direction till he arrived at the point where he wished to place it. The long and large materials were always taken first, and two of the longest were generally laid crosswise: the area thus formed he would fill up with hand-brushes, rush-baskets, books, boots, sticks, cloths, dried turf, or anything portable. As the work grew high, he supported himself on his tail, which propped him up admirably, and he would often, after placing his building materials, sit up over against it, as if to consider his work; and sometimes he would change the position of the materials. After he had piled them up in one part of the room, generally the same place, he proceeded to wall up the space between the feet of a chest of drawers, which stood at a little distance, high enough on its legs to make the bottom a roof for him; using for this purpose dried turf and sticks, which he laid very even; and filling up the interstices with bits of coal, hay, cloth, or anything he could pick up. This

last place he seemed to appropriate for his dwelling; the former work for a dam. When he had walled up the space between the feet of the chest of drawers, he proceeded to carry in sticks, cloths, hay, and cotton, and to make a nest; and when he had done, he would sit up under the drawers, and comb himself with the nails of his hind-feet, to keep his fur in order, and cleanse it from dirt. Binney generally carried small and light articles between his right fore-leg and his chin, walking on the other three legs: he pushed large masses forward, leaning against them with his right fore-paw and his chin. He never carried anything on his tail, which he liked to dip into water, but he was not fond of plunging in the whole of his body. If his tail was kept moist, he never cared to drink; but, if it was kept dry it became hot, and the animal appeared distressed, and would drink a great deal. Bread, and bread and milk and sugar, formed the principal part of Binney's food; but he was very fond of juicy fruits and roots. He was a most entertaining creature, and some highly comic scenes occurred between the worthy but slow Beaver, and a light and airy macauco that was kept in the same apartment.

American Beavers at work have been exhibited at the Zoological Society's menagerie in the Regent's Park. A male and female Beaver were sent to the Society from Canada, by the late Earl of Dalhousie: both partially lost their sight on their passage to this country, a circumstance which did not impede the exercise of their peculiar instinct as far as captivity would admit. A dam of mimic rockwork was constructed for the Beavers in the garden, in a small pond or tank of water, when they soon commenced finishing the interior in the manner customary with them in a state of nature.

Hitherto, we have but spoken of the American Beaver. Of the European, which is believed to be but a variety of the same species, we possess a very interesting history. Herodotus describes the Beaver of Europe as inhabiting a large lake in the country of the Budini, a nation on the Upper Don: he mentions the skins as used for clothing. Aristotle slightly notices the Beaver; while Pliny well describes it.

That the Beaver was formerly an inhabitant of the British Islands there is no doubt. Giraldus Cambrensis, who journeyed into Wales towards the end of the twelfth century, on arriving at the confines of the river Teivi, in Cardiganshire, notes that "of all the rivers of Wales, this alone possesses Beavers;" and he mentions that in the course of time the habitations of these Beavers assume the appearance of a grove of willow-trees, "rude and natural without, but artfully constructed within," that "the Beaver hath four teeth, two above, and two below, which cut like a carpenter's axe; and that it has a broad, short tail, thick, like the palm of the hand, which it uses as a rudder in swimming." He describes its cutting down trees with its teeth, in considerable quantities, and constructing huts on the banks of rivers, as well as burrows, which it inhabited. The huts had sometimes two, or even three apartments, and these were on different stories. "Two or three waters in the Principality," says Pennant, "still bear the name of *Llyn yr a fange*, or the Beaver Lake." Pennant traced two of their supposed haunts: one in the stream that runs through *Nant Françon*, the other in the river Conway, a few miles above Llanwrst; and both places, in all probability, had formerly been crossed by Beaver-dams. But, they must have been very scarce even in earlier times; for, the laws of Hywel D'ha, or Howell the Good, of the ninth

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BEAVERS AT WORK.

century, the price of a beaver's skin was fixed at a hundred and twenty pence, a great sum in those days. Giraldus also refers to Scotch Beavers, which had become very scarce in 1150. Tradition refers the name and arms of the town of Beverley, in Yorkshire, to the fact of Beavers having abounded in the neighbouring river, Hull. It is certain that the bones and teeth of Beavers, discoloured by the earth, but otherwise little altered, are by no means rare in the superficial deposits or till of Lincolnshire and Cambridgeshire. Professor Owen, in his History of British Fossil Mammals, mentions the discovery of the skeleton of a Beaver in the bed of the Old West Water, about three miles south of Chatteris; this channel being between the Ouse and the river Nen, which, say the Fen people, has been choked up for two centuries: the peat-bog is a very common situation in which remains of the Beaver are found in this island.

George Agricola, the celebrated metallurgist, in a treatise written in 1547, mentions the Beaver as hunted in Germany, in his time, for the sake of its tail which was eaten, the skin which was used for dress, and its *castoreum*, which was employed in medicine; and he repeats the stories of the skill of the animal in the preparation and adaptation of the materials for its buildings. Olaus Magnus, Archbishop of Upsala, in the sixteenth century, records the existence of the Beaver in the Scandinavian countries, where it was found in the greatest abundance, constructing its two and three chambered houses with wonderful art; and far later, in the middle of the eighteenth century, Pontoppidan describes Beavers as still numerous in Norway, there being then a considerable trade in their skins, and in castoreum, at the fair of Elverum. Linnæus, in his Fauna of Sweden,

includes the Beaver as inhabiting lakes and rivers, especially in Lapland.

Belon, whose early death by assassination, (1564,) in the Bois de Boulogne at Paris, was regretted as a great loss to the science of natural history, speaks of the Beaver as common in France; and he describes it further as abundant elsewhere in Europe, and as frequently kept tame among the Burgundians, Lorrainers, and Austrians. Rondelet mentions it as found in the Rhone, and gives an interesting account of two tame Beavers kept by the Bishop of Montpellier. Pornet, in the seventeenth century, also mentions the Beaver in the Rhone, the Lisère, and the Oise; and says that great numbers were taken along the Elbe. Gesner describes Beavers in rivers and lakes of Switzerland. Dante does not recognise the Beaver as a native of Italy, but refers to its presence in the Danube. The noted Scaliger mentions the Beaver as existing in France and Germany, but does not claim it for his own country. Strabo describes the Beaver in Spain, and we have the unquestionable evidence of fossil teeth in the Val d'Arno. We have proofs of the former existence of the Beaver in Great Britain, France, Switzerland, Germany, Austria, Russia, Norway, Sweden, and Denmark; to which may be added the fact, that remains of the animal have been found by M. Morren, in the peat of Flanders; so that we have evidence of the distribution of the Beaver, and often in great numbers, over nearly the whole expanse of Europe. Their bones have been found in mosses in the valley of the Somme, in France; as well as near Paris, at the confluence of the Seine and Marne; and in the cave of Lunelviel; as well as in Switzerland.

We find a great similarity in the name of the animal throughout the kindred languages of the Indo-Germanic races,

whether in Europe or Asia. The names of localities and of individuals have risen as naturally in foreign countries as among ourselves, from the presence of the Beaver. The river Fibrenus, in Latium, from *fiber*, is an instance. Biberach, or Biberbach, in Suabia, had its designation from the Beaver, which had colonies in a brook or stream in its vicinity. This town was an old *Reich-stadt*, and like our Beverley, had long carried the Beaver in its armorial insignia. There is likewise a Bierberach, a tributary of the Rhine; and on the Rhine itself we have Biebrich, probably, the analogue of our *Beferige*, whence our patronymic *Beveridge*. The brothers Grimm, in their elaborate Dictionary, under the word *Biber*, give besides Biberha, Biber, Bebra, Beberbeke, and Bever, as names occurring throughout all districts of Germany, and as easily resolvable into indications of the old haunts of the Beaver.* Of surnames of individuals, we have the Russian Bobroff, the Polish Bobrowski, the German Bibra and Bieber, and the French De Bièvra. In England we have the surnames Beaver, Beever, and Beevor; Beavers and Beevers; with, besides Beveridge, Beaverstocks and Beverley.†

Thus, we have proofs of an acquaintance with the gregarious habits and constructive instincts of the Beaver, long anterior to the discovery of America, and to the more widely-diffused knowledge which followed gradually upon the narratives of the voyagers to the New Continent. Now, so accomplished

* Petersen derives the ancient name Byaurœrsk-ogshœreth, in Denmark, from a like source; and alludes to the introduction of the Beaver into the well-known legend of King Snjo, in the Chronicle of Eric of Pomerania. We remark also, in Silesia and Lithuania, the Sclavonic name Bober, as that of a river; as well as in France the little river Bièvre.

† See the learned paper in Edinburgh New Philosophical Journal, 1858.

a writer as Buffon not only overlooked this fact, but many others of the actual life and habits of the Beavers. He says, they never assemble in colonies, and never construct, but merely burrow; though he admits that in Norway, and other parts of the extreme north, their huts have been reported to be found within the last centuries. Cuvier followed Buffon, in assuming that the European Beavers, at least in later ages, never build; and states the difficulty he has had in attempting to determine, whether those which now have their burrows along the Rhone, the Danube, the Wieser, and other rivers, are originally different from the American species, or whether they are identical, and are hindered from building solely by their position in the nearer vicinity of man. Desmordius denies that societies of Beavers have ever been seen in Germany.

To approach our own times, Bechstein, writing in 1801, tells us that on the Elbe, near Kähnert, there were then many Beavers, which constructed dams, where there was calm water. Near Wittenberg, also, they lived in societies, and formed dams; as well as near Hettinghausen, on the Lippe, and higher up the river. In these localities, their buildings are said to have been so skilful as to rival those of Canada, though the colonies were less numerous; the trees they cut down were willows and poplars. Oken mentions a beaver-hut on the Yesil, in the duchy of Cleves, which stood six feet high, with two chambers over each other, the upper having three and the under four cells; and Meyerink, in the *Berlin Natural History Transactions* for 1829, describes a colony settled for upwards of a century on the little river Nuthe, half a league above its confluence with the Elbe, in a sequestrated canton of the district of

Magdeburg: in 1822 it contained from fifteen to twenty Beavers; they had burrows, built huts eight or ten feet high, using trunks and branches of trees, along with earth; and constructed a dyke. Martius, in 1837, speaks of colonies of Beavers on the Ammer, which were still tended as objects of forestry, or huntsman's craft. An authority at the close of the last century, assigns to Beavers many localities in Germany.

Even within these twenty years, the Beaver, though scanty in its relative numbers, has a wider distribution in Europe than is usually imagined. Wagner, writing in 1846, describes it as still not only in the Danube, but in the Ambar, Isar, Iller, and Sabrach, tributaries of that river; as well as in the Elbe and Oder; while in other rivers it has only recently disappeared. In Norway, Sweden, and Poland, he reports them in greater numbers, and as distributed over Russia. They occur in Transylvania, and in the Traun in Austria. But a few years ago, they were observed in the Lippe, in Westphalia; and they are still found on the Elbe, though the colonies, since 1848, have been greatly reduced. Wylie, in the Russian Military Pharmacopœia, mentions the Beaver as common in Russia and Siberia, and more rare in Livonia and Poland. In South Russia, Demidoff says that they are somewhat scarce on the Danube, but that they are more common in the region towards the Caucasus.

Although we have enumerated the resorts of the Beaver in France, it holds out there but as a solitary, or unsocial water-animal, and limited to the Rhone. Here its days are plainly numbered. The damage that Beavers commit on neighbouring plantations, especially those of the willow; the price of their pelt; their bags of castor,—still a valuable drug; their flesh, which is eaten on maigre-days, the species

being a canonical fish; the pains which naturalists take to procure a "native" beaver for their museums—all these influences combine to hasten the period of the utter extirpation of the poor Beavers of the Rhone. The last specimens that are recorded as victims of the chase were taken at Arles, at Beaucaire, and as far up the Rhone as Avignon. Some Beavers have even ascended as high as the Pont d'Esprit. Occasionally, a Beaver has been known to enter the rivers Gardon and the Durance. Those that remain in the Rhone frequent the islands of that river, concealing themselves in the large burrows which they make in the steep banks. Nowhere now are any attempts to construct dykes or communal residences ever detected; but in the thirteenth century, such constructions, analogous to those of the Beavers of the North American rivers, were occasionally met with on the Rhone, and are described by Albertus Magnus. An old Beaver-barrack, was, it seems, once accidentally exposed by the giving way of a dyke about three leagues from St. Galles (Gard). It had lodged many Beavers, its interior being divided into several compartments. One of these contained branches of willows, some of which, after becoming fixed in the earth, put forth leaves and branches. In general, the season of the rise of the Rhone is that in which the Beavers are captured. The swollen waters inundate their islands and lofty banks, and the poor industrious amphibians are compelled to seek higher ground, both for air and food; they thus become exposed, and are brought within the view and reach of their sole enemy, man, by whom they are either killed or captured. It was thus that, in 1846, a fine Beaver was taken near the gates of Avignon.*

* Saturday Review, 1856.

The Beaver, from its magnitude, and the temptations of its spoils, has not receded from the presence of man without some efforts for its defence. Like other objects of the chase, it was held, from a very early period, as royal game; and an officer, styled the Beverarius, appointed for its cognizance, was among the retinue of the palace of the Frankish sovereigns. It was pursued with all the appliances of spear, net, and hound. In the laws of the Bavarians, of the time of King Dagobert I., (seventh century,) we find a fine of six solidi imposed upon whomsoever should kill a beaver-hound, along with the restitution of a similar animal. This hound still appears in the most recent Swedish Dictionary, as "a dog trained for the chase of the Beaver," though few are now exercised. In a German charter, dated 1103, the right of hunting Beavers is conferred along with other huntings and fishings; and a Bull of Pope Lucius III. (1182,) bestows upon a monastery the property of the Beavers within their bounds. The Beaver in the Elbe has been, in modern times, protected by a Russian royal edict: one issued in 1725 insisted upon the protection under a penalty of no less than 200 dollars. Under a similar policy, Frederick the Great is reported to have gathered together a large colony of Beavers, that he might turn them to economical uses; but with so little success, says Zimmermann, that they became afterwards dispersed throughout Brandenburg, and were soon rarely encountered.

The employment of the flesh of the Beaver as an article of diet has been mentioned. Stresco, a Dutch writer, states that the animal was used as food in Holland, in the time of the Crusades; and that its tail and paws were eaten as fish, during the religious fasts. But the monks of a convent of

Chartreux, at Villeneuve-les-Avignon, accounted the entire carcase as maigre, and prepared from it large quantities of sausages, which were sold, and highly prized in the adjoining country. Albertus Magnus, however, says that the whole flesh was abominable, except the tail. Gesner describes the mode in which it was rendered savoury by the Swiss, he himself praising the choicer portions as sweet and tender. Belon also tells us that in his day the tail, sometimes weighing four pounds, was used during Lent, in Lorraine, and accounted a great delicacy, having a close resemblance in flavour to a nicely-dressed eel. The northern nations considered the tail and paws as highly delicate morsels; and in their old kitchen heaps, which have lately attracted attention in Denmark, have been found the remains of the now extinct Beaver.

The skin of the Beaver has long been prized in Europe as a fur, in dress and manufacture. Herodotus tells us that the Budini Scythians used it as trimming for their cloaks. We have seen the value attached to it in Wales, in the time of Hywel D'ha; but this value seems to have fluctuated. Adam of Bremen, in the eleventh century, reckons Beaver-skins among the objects of vanity which crazed his contemporaries; but Albertus Magnus, in the thirteenth century, says that they were formerly precious, but then of little value; while Olaus Magnus, so recently as the sixteenth, states they were much prized among the northern magnates. Belon mentions that in France cloaks and gloves were made of the fur against the inclemency of the weather: and it was sought in this country by foreigners at a great cost. Even now, a Beaver skin of the finer description, from Kamtschatka, is said to sell in Russia

for from 100 to 150 roubles. In England, in 1836, the price of the skin of the old Beaver from Canada was 1*l.* 12*s.* 6*d.*

In England, the chief use of the fur of the Beaver has been in the manufacture of beaver hats, which have been known since the time of Chaucer, who describes the merchant in the *Canterbury Tales*, with "on his head a Flaundrish bever hat." Beaver hats are thought to have been introduced into this country at the Norman Conquest; for they are mentioned in Normandy at a still earlier period. Felting is much more ancient than weaving; and a hat for the King of France in 1351, mentioned by Du Cange, is considered to have been a hat felted from the fur of the Beaver. Yet beaver hats were not made in England up to the close of the sixteenth century, when they were "fetched from beyonde the seas." Pennant assigns to the time of Charles I. the commencement of their manufacture in England; by a Government regulation of 1638, all materials for making hats, except Beaver stuff and wool, were interdicted. They were in high repute in 1663, when they were called *castors*, and the song was:

> of all felts that may be felt,
> Give me your English beaver.

Nutria, the wool of the coypou, has been substituted for beaver-wool, on second-rate hats: "superseded as it is of late in the making of hats, the skin of the Beaver, notwithstanding its increasing scarcity, would have sunk to even a lower than its present value, had it not been that a new process has been contrived in which the surface is cut off by an ingenious machine, with the result of producing a fur of a

higher beauty, exported to various parts of Europe and the East. The rich white wool, it may be added, from the under part of the Beaver, seems to find a ready market in France."*

We have now seen the economic uses of the Beaver as diet in its flesh and clothing in its fur; but there remains to be described its *castoreum*, known as a drug, we learn from Æsop, in the sixth century before Christ. It is found in pouches on the Beaver. It is recommended by Hippocrates. Pliny describes its wonderful uses in medicine: rubbed on the hand it induced sleep; it was a remedy for epilepsy and certain poisons, and for spasms, nervous complaints, sciatica, dyspepsia, hiccup, and palsy; it cleared the eye-sight, and relieved ear-ache and tooth-ache. Galen styles it a celebrated medicine, and Archigenes wrote a whole book about it. Our countryman, John of Gaddesden, (the first English Court physician,) was familiar with its uses, especially in the diseases of women. But the Beaver, in all its parts, ranked with our predecessors as a complete *armoury of physic:* its oil cured lethargy, apoplexy, spasm, convulsions, and rheumatism, asthma, nausea, and colic; its tail, as food, healed inner wounds; the blood was beneficial in epilepsy; and the teeth, hung from the neck, promoted dentition; or in adults served as an amulet to preserve from casualties. The gall cured affections of the eyes, and the fur stopped bleeding from wounds, an old reputation which lasted to our day: so long as beaver hats were worn, to apply a little fur to stop bleeding from a leech-bite, or cut, continued a remedy. The Beaver-skin was made into slippers, stockings, and gloves, for gouty patients. The finer quality of Beaver fur, formerly known as "flix," was used not only for hats, but also for hosiery

* Edinburgh New Philosophical Journal, 1858.

purposes—in allusion to which Dyer, in his poem of "the Fleece," has these lines:

> The Beaver's flix
> Gives kindliest warmth to weak, enervate limbs,
> When the pale blood slow rises through the veins.

When newly stripped from the animal, and applied warm, castoreum was serviceable in colic, and even in mania. There is an ancient Jewish tradition, from King Solomon, that to wear a Beaver hat, rub the head and spine with oil of castoreum, and swallow the weight of a gold piece of its substance twice a day, made the memory so retentive that it lost nothing. The castoreum was a remedy for countless other ailments; so that the Dispensatory of 1718 might well say of it: "Certainly it is a most noble drug." Yet its reputation has been declining throughout Europe for a century past. The American castor has strangely fallen in value, and the European variety is priced at from 12 to 16 times the cost of that from Canada. It has been reported to the Imperial Society of Physicians at Vienna, that the castor-pouch of a Beaver recently captured in Transylvania, was bought by a druggist for 362 florins, or 36*l.* sterling; and, as it is sold in Vienna at 1*s.* 6*d.* per grain, the proceeds of this individual pouch would be 261*l.* To prescribe it in two-dram doses, therefore, twice a day, would entail a charge upon the patient of 27*l.* sterling daily. Castor is still occasionally used in this country, but only as tincture: it is of very uncertain quality.

One of the best authenticated accounts of the Beaver with which we are acquainted, is the Adventures of Captain Bonneville, which Washington Irving gracefully narrated some thirty years since. The Captain was of French parent-

age, and in the United States army; and, in a rambling kind of enterprise, strangely engrafted the Beaver trapper and hunter upon the soldier. For a number of years he was stationed at various parts in the Far West. During a mid-day halt in one of the Beaver valleys, Captain Bonneville left his companions, and strolled down the course of the stream to reconnoitre. He had not proceeded far when he came to a Beaver-pond, and caught a glimpse of one of its painstaking inhabitants busily at work upon the dam. The curiosity of the Captain was aroused, to behold the operations of this far-famed architect: he moved forward, therefore, with the utmost caution, parting the branches of the water-willows without making any noise, until having attained a position commanding a view of the whole pond, he stretched himself flat on the ground, and watched the solitary workman.

In a little while, three other Beavers appeared at the head of the dam, bringing sticks and bushes. With these they proceeded directly to the barrier, which Captain Bonneville perceived was in need of repair. Having deposited their loads upon the broken part, they dived into the water, and shortly re-appeared at the surface. Each now brought a quantity of mud, with which he plastered the sticks just deposited. This kind of masonry was continued for some time, repeated supplies of wood and mud being brought. This done, the industrious Beavers indulged in a little recreation, chasing each other about the pond, dodging, and whisking about on the surface, or diving to the bottom; and in their frolic often slapping their tails on the water, with a loud clacking sound. They were now joined by another Beaver, who looked gravely at the sports for some time, without offering to join in them. He then climbed the

bank close to where the Captain was concealed, and rearing himself on his hind-quarters, in a sitting position, put his fore-paws against a young pine-tree, and began to cut the bark with his teeth. At times he would tear off a small piece, and holding it between his paws, and retaining his sedentary position, would feed himself with it after the fashion of a monkey.

The object of the Beaver, however, was evidently to cut down the tree; and he was proceeding with his work, when he was alarmed by the approach of Captain Bonneville's men; all the Beavers, busy as well as idle, then dived at once beneath the surface, and were no more to be seen. The Captain regretted this interruption. He had heard much of the sagacity of Beavers in cutting down trees, in which, it is said, they manage to make them fall into the water, and in such a position and direction, as may be most favourable for conveyance to the desired point. He was "belting" this tree—a tall straight pine—and had made his first incision on the side nearest to the water.

Captain Bonneville, however, discredits, on the whole, the alleged sagacity of the Beaver in this particular, and thinks the animal has no other aim than to get the tree down, without any subtle calculation as to its mode or direction of falling. This attribute, he considers, has been ascribed to Beavers from the circumstance, that most trees growing near water-courses either lean bodily towards the stream, or stretch their largest limbs in that direction. The Beaver, of course, attacks those trees which are nearest at hand, and on the banks of the stream or pond. He makes incisions round them, or, in technical phrase, *belts* them with his teeth; and when they fall, they naturally take the direction in which their trunks or branches preponderate.

Hear a piece of evidence in the Captain's own words: "I have often seen trees measuring eighteen inches in diameter, at the places where they had been cut through by the Beaver, but they lay in all directions, and often very inconveniently for the after purposes of the animal. In fact, so little ingenuity do they at times display in this particular, that at one of our camps on Snake River, a Beaver was found with his head wedged into the cut which he had made, the tree having fallen upon him and held him prisoner until he died."

Great choice, according to the Captain, is certainly displayed by the Beaver in selecting the wood which is to furnish bark for winter provision. The whole Beaver household, young and old, set out upon this business, and often make long journeys before they are suited. Sometimes they cut down a tree of the largest size, and then gather the branches, the bark of which is most to their taste. These they cut into lengths of about three feet, convey them to the water, and float them to their lodges, where they are stored away for winter food.

Beavers are studious of cleanliness and comfort in their lodges, and after their repasts, carry out the sticks from which they have eaten the bark, and throw them into the stream beyond the barrier: the sticks are, so to speak, the bones of their meal. Beavers are jealous of their territories, and exceedingly pugnacious, never permitting a strange Beaver to enter their premises; and they often fight with such fierceness as almost to tear each other to pieces. In spring, which is the breeding-season, the male leaves the female at home, and sets off on a tour of pleasure, rambling often to a great distance, recreating himself in every clear and quiet expanse of water on his way, and climbing the banks occasionally to feast upon the tender sprouts of the young willows. As summer advances,

he gives up his bachelor rambles, and bethinking himself of housekeeping duties, returns home to his mate and his new progeny, and marshals all for the foraging expedition in quest of winter provisions.

After having shown the public spirit of this praiseworthy animal, as a member of a community, and his amiable and exemplary conduct as the father of a family, we grieve to record the perils with which he is environed, and the snares set for him and his painstaking household.

Practice, says Captain Bonneville, has given such quickness of eye to the experienced trapper in all that relates to his pursuit, that he can detect the slightest sign of a Beaver however wild; and although the lodge may be concealed by close thickets, and overhanging willows, he can generally at a single glance, make an accurate guess at the number of its inmates. He now goes to work to set his trap; planting it upon the shore, in some chosen place, two or three inches below the surface of the water, and securing it by a chain to a pole set deep in the mud. A small twig is then stripped of its bark, and one end is dipped in the "medicine," as the trappers term the peculiar bait which they employ. This end of the stick rises about four inches above the surface of the water, and the other end is planted between the jaws of the trap. The Beaver, possessing an acute sense of smell, is soon attracted by the odour of the bait. As he raises his nose towards it, his foot is caught in the trap. In his fright he throws a somersault into the deep water. The trap being fastened to the pole, resists all his efforts to drag it to the shore; the chain by which it is fastened defies his teeth; he struggles for a time, and at length sinks to the bottom, and is drowned.

Upon rocky bottoms, where it is not possible to plant the

pole, it is thrown into the stream. The Beaver, when entrapped, often gets fastened by the chain to sunken logs on floating timber; if he gets to shore, he is entangled in thickets of the brook willows. In such cases, however, it costs the trapper a diligent search, and sometimes a bout at swimming, before he finds his game. Occasionally it happens that several members of a Beaver family are trapped in succession. The survivors then become extremely shy, and can scarcely be "brought to medicine," to use the trapper's phrase for taking the bait. In such cases the trapper gives up the use of the bait, and conceals his traps in the usual paths and crossing-places of the household. The Beaver now being completely "up to trap," approaches them cautiously, and springs them ingeniously with a stick. At other times he turns the traps bottom upwards, by the same means, and occasionally even drags them to the barrier, and conceals them in the mud. The trapper now gives up the contest of ingenuity, and shouldering his traps, marches off, admitting that he is not yet "up to Beaver."

We have thus narrated the natural economy and real life of the Beaver, and the historical interest by which it is characterized. It would be difficult to name an animal, in whose history so much exaggeration can be traced; but, with all the deductions which truth compels us to make from the accounts of old writers, there remains a very remarkable amount of interest, extending through more than twenty-four centuries. This antiquity may, in some measure, explain the scorn with which beaver-hatters have looked down upon the operation of silk-hatting; the processes of the former present the most remarkable manipulative skill, acquired by long practice.

X.

RATS.—MICE.—LEMMINGS.

THE Brown Rat has now been with us about a century and a quarter. Those who are best informed on the subject fix the appearance of this Rat in England about the year 1737. It found its way to Paris about the year 1750. There is every reason for concluding that it came to us originally from Asia, where it was known long before we have any account of its appearance in Europe. It probably first came to us in ships from the East Indies. From Persia it made its way westward to St. Petersburg: so that there would be some sense in speaking of it as the Russian Rat. As to calling it the Norway Rat, as if that were the country from which it first came, the animal was quite unknown in Scandinavia when the name was applied to it. America first received it by a ship from Antwerp. George (Louis) the First was born in 1660, and came over to England in 1681, intending to pay his addresses to the Princess Anne, who was afterwards Queen, but had hardly landed when he received his father's injunction to proceed no further in that business, and returned. In 1714 (28th September) he arrived at Greenwich as king. George (Augustus) the Second succeeded his father in 1727. We find no notice of the Brown Rat being in this country till ten years after the last-named date,

when George the First had been long dead. When the Brown Rats came they found the ravenous Black Rat in possession, forthwith made war upon their sable relations to their almost total extermination, and substituted one plague for another. But that George the First brought with him his "half-starved ratten" is a fable; though to the Black Rat, the King's rat-catcher, with his scarlet dress, embroidered with yellow worsted, and figures of mice or rats destroying wheatsheaves, may have owed his office in this kingdom.

In the winter of 1797, the Rats in the Feroe Islands had nearly got the better of their direct enemies. A plague then prevailed among the Cats in Feroe; there was a very general mortality among them about the same time in England, and that it should have prevailed in these remote islands when it could not possibly have been communicated by contagion, is a remarkable fact. Sea-bathing was tried with little effect; emetics were administered successfully, but the cases were not sufficiently numerous to establish a remedy. The life of a domestic Cat is of some value there, for Rats are very numerous: they will destroy a corn-field in the course of two nights, and when they cannot get at the sea-fowl, they commit such havock among them, that they leave little to be done by the fowlers. They have, however, since their introduction, nearly rid the islands of mice. The Hanover Rat made its appearance there in 1768, arriving upon the wreck of a Norway ship which was lost on the Island of Lewis, and drifted to Suderoe. It is observed that he will not touch anything that is poisoned: sagacious as the Rat is, this must be owing to the want of skill in disguising the poison, for in England, of which these vermin have made a more complete conquest than any former invader (having literally exter-

minated the original rat of the country), poison is the most common method of destroying them.

Some fifty years ago, the plantations in the Forest of Dean, in Gloucestershire, had to encounter the attacks of an enormous number of Mice. It was during the year 1814 especially, but to a certain degree also in the preceding and succeeding ones, that this Forest and the New Forest were visited with myriads of Mice. They appeared in all parts, but particularly in Haywood enclosure, destroying a very large proportion of the young trees, so that only four or five plants to an acre were found uninjured by the Mice. The roots of five years' old oaks and chestnuts were generally eaten through just below the surface of the ground, or wherever their runs proceeded. Sometimes they were found to have barked the young hollies round the bottom, or were seen feeding on the bark of the upper branches. These Mice were of two kinds, the common long-tailed Field Mouse, and the short-tailed. There were about fifty of these latter sort to one of the former. The long-tailed Mice had all white breasts, and the tail was about the same length as the body. These were chiefly caught on the wet greens in the Forest, and the short-tailed were caught both on the wet and dry grounds.

A variety of means were resorted to for their destruction, such as cats, poisons, and traps, but with little success. A Mr. Broad, who had been employed by the Admiralty, and had been successful in killing the Rats and Mice in the Fleet, was sent down, and tried several plans, all of which failed. At last, a miner living on Edge Hills, named Simmons, came forward, and said that he had often, when sinking wells or pits, found Mice fallen in, and dead, in consequence of their endeavours to extricate themselves, and he had little doubt

that the same plan would succeed in the Forest. It was tried, and holes were dug over the enclosures about two feet deep, and the same size across, rather hollowed out at the bottom, and at the distance of about twenty yards apart, into which the Mice fell, and were unable to get out again. Simmons and others were employed, and paid by the numbers of tails which they brought in, amounting in the whole to more than 100,000. In addition to this it may be mentioned that polecats, kites, hawks, and owls visited the holes regularly, and preyed upon the Mice caught in them; and a small owl, called by Pennant, *Strix passerina*, never known in the Forest before or since, appeared at that time, and was particularly active in the destruction. The mice in the holes also ate each other.

Among the quadrupeds which astonish us by their vast numbers is the Norway Lemming, as large as a rat, but with black and yellow fur. M. Guyon lately exhibited to the French Academy of Sciences a living specimen of the Lemming, which he had just brought over from Norway. The genus Lemming is formed of a group of small mammals spread over the northern regions, and remarkable, among other things, for their emigration, which, however, is not periodical. The Norway Lemming dwells on the summit of mountains, and principally feeds on lichens and mosses. Like its congeners, it sleeps by day, and awakes only at the approach of night, when it becomes exceedingly active, putting out all its strength at once in tearing up, gnawing, and murmuring.

Some years have elapsed since it emigrated; but in the spring of the year 1864, emigration recommenced in smaller numbers than usual. In their ordinary manner, the animals spread themselves over the country, following the direction of

rivers and lakes. During his tour in Norway, M. Guyon, in his passage to Lillehamer, on the Lake Miœsen, in the first fortnight of July, saw great numbers of Lemmings running through the gardens and houses, the streets being strewn with their dead. In spite of its delicate structure, the Lemming is full of strength and courage. It flees when pursued, at first; but soon stops, and makes a lively defence by the help of its claws and sharp teeth, uttering very acute cries. Lemmings are accused of devouring each other, in certain circumstances; and those caught generally have wounds on the shoulders.

M. Guyon has examined the three supposed causes of their emigration:—1. The animal's presentiment of a severe winter. If this were the case, the emigration would take place at a time more or less near winter; but last year it took place in spring. 2. The failure or scarcity of food. Now, last year (says M. Guyon), the lichens and mosses of the mountains were as abundant as in preceding years; 3. The great multiplication of the animal in certain years, which seems to be the most plausible cause. According to all the probabilities, the direction which the Lemmings follow in emigrating is given by the declivity of the land. It appears that at a given moment in the years of emigration they descend their respective mountains and unite at their base, proceeding across the country in close columns, which, in inhabited places, are rapidly thinned by death through the feet of men and the teeth of dogs, cats, foxes, and other animals. It is said that even the reindeer, although herbivorous, will not spare them. The escaped Lemmings quit their mountains for ever, leaving only a few to continue the species.

M. Guyon found the specimens which he captured to be

voracious feeders, drinking frequently. As the Lemming had never been seen alive in France, he endeavoured to bring home five. Three of these died before he quitted Norway. The other two, embarked on the North Sea, endured a maritime life very well, eating freely biscuits, almonds, nuts, raisins, &c., combined with the products of their native mountains, such as rubus *arcticus*, and *vaccinium*. Things went on very favourably at Paris, after their arrival, till one of the captives was found dead in his cage. M. Guyon, fearing that the remaining one would not long outlive its companions, was induced to submit it to the examination of the members of the Academy, by whom it was regarded with much interest.

The Lemming barks very nearly like a dog; and the vulgar believe that Lemmings fall from the clouds like rain. Their method of crossing rivers and branches of the fiords was thus related to M. de Capell Brooke, by an eye-witness:—"On arriving at the edge of the water, the foremost advance, and swimming across, form a kind of floating bridge, or, to use a military term, pontoon; the head of each supported by the hinder part of that before it. When a communication is thus formed between the shores, the remainder of the army pass rapidly over the backs of the supporters, and gain the opposite bank. Strange as this may seem," continues M. de Capell Brooke, "the contrivances which naturalists agree are resorted to both by the Marmot and Grey Squirrel, for the purpose of crossing rivers, appear extraordinary, though well authenticated; and what has been thus mentioned concerning the Lemming will, I doubt not, be received with attention by those who have made natural history more particularly their study, and can better judge of the extraordinary instinct and sagacity of the animal creation."

The Marmot, which has just been incidentally mentioned, is found in the Alps and Pyrenees. It lives in little societies; its west chambers are lined with moss and hay, and here it dozes away the inclement months, from five to a dozen being lodged in a chamber. When on their feed, a sentinel is placed to watch, and on the approach of danger, his whistle drives them instantly to their subterranean retreats. They are playful creatures; but when angry, before a storm, pierce the ear with their shrill whistle. In the strictest sense, Marmots make hay: they bite off grass, turn it, and dry it in the sun. It is reported that they use an old she-marmot as a cart: she lies on her back, the hay is heaped on her belly, and two others drag her home. (See *Medical Gazette*, 1828).

XI.

CURIOSITIES OF THE CAMEL.

HE who has contemplated the more fertile regions of the earth, their luxuriant productions, and dense population, must be struck with horror when he beholds the Deserts of Arabia and Africa, and sees around him a vast extent of dry and burning sand, unfavourable alike to animal and vegetable life. But when he comes to examine the structure of the Camel, he finds, in the peculiar conformation of its foot and stomach, a beautiful illustration of the care which nature has taken in adapting animals to particular localities. From this it may be inferred that the Desert is not an accidental defect, an unplanned eyesore on the earth's surface owing its existence merely to the effects of a destructive power defacing the fair form of nature, but is a settled part of the great scheme of creation; and the animal thus provided is poetically described by the Arabian epithet, the *Ship of the Desert.*

If it had been proposed to construct an animated machine that should be best calculated to meet the exigencies of the animal, where could we find a better solution of it than in the construction of the Camel? The pads or sole-cushions of the spreading feet are divided into two toes, without being externally separated; these buoy up, as it were, the whole bulk with their expansive elasticity from sinking into the

sand, on which the animal advances with silent steps—the nostrils so formed that it can close them at will to exclude the drift-sand of the parching simoom—the powerful upper incisor teeth for assisting in the division of the tough pricky shrubs and dry stunted herbage of the Desert—and above all, the cellular structure of the stomach, which is capable of being converted into an assemblage of water-tanks—bear ample testimony to the care manifested in the structure of this extraordinary quadruped. Mr. Macfarlane has well described "the *noiseless* step of the Camel from the spongy nature of his feet. Whatever be the nature of the ground, sand, or rock, or turf, or paved stones, you hear no foot-fall; you see an immense animal approaching you *stilly* as a cloud floating on air, and unless he wear a bell, your sense of hearing, acute as it may be, will give you no intimation of his presence."

The two species of Camel were known to Aristotle, who, in his Natural History, mentions both the Arabian and the Bactrian, remarking that the latter has two humps, and the former has one. That accurate observer also describes the peculiar mode of the Camel's walk to be by raising the two legs of the same side, the one immediately after the other; not moving the two legs diagonally in the manner of most other quadrupeds.

Herodotus tells us that horses tremble when they see a Camel—that they cannot bear either the sight or the smell of a Camel; upon which Larcher, in his edition of Herodotus, remarks that familiarity with the Camel soon subdues this natural shyness in the horse. The authoress of *Adam Bede* has cleverly availed herself of this fact in that able work, wherein she says, in reference to "the smart rap, as if with

a willow wand," given twice "at the house door" (the death-warning of Mias Bede the night he was drowned)—"Adam was not a man to be gratuitously superstitious, but he had the blood of the peasant in him, as well as of the artizan; and a peasant can no more help believing in a traditional superstition than a horse can help trembling when he sees a Camel."

Of the history and natural economy of the Camel, his pilgrimages and journeyings across the Desert, we have many very interesting accounts. One of the latest is that published a few years since, by Mr. Marsh, who, during his residence in the Turkish Empire as United States Minister, enjoyed peculiar opportunities for investigating the question of introducing the Camel into the United States for economical purposes—a subject which had previously engaged much of his time and attention. Mr. Marsh's volume is a carefully digested summary of the information in regard to the natural history and peculiar habits of the Camel that is found in the most authentic sources, together with the results of extensive personal observation.

The disposition of this animal, which had received almost universal praise from traditional writers until the "Howadji in Egypt" expressed a strongly dissenting opinion, shows less amiable traits than he has usually been clothed with in the descriptions of imaginative travellers. Mr. Marsh tells us that the Camel, though less vicious than the horse, is not altogether so patient an animal as he is generally represented. His anger is indeed not easily excited, but when once thoroughly irritated he long remembers the injury which has provoked him; and the "Camel's temper" is a proverbial expression used by the Arabs to denote a vin-

dictive and unforgiving disposition. Although he sometimes strikes with the forefoot, yet the hoof being unarmed, his blows are feeble, and his only dangerous weapon is his teeth. These are used with powerful effect in the barbarous fights which are sometimes got up as spectacles; but it is only under certain special circumstances, which are easily avoided, that he attacks his driver.

His only ordinary manifestation of discontent is the harsh and ill-natured growl he sets up whenever he is approached to be loaded or mounted, and especially when any attempt is made to overcharge him. In the stillness of the Desert the growl of a caravan, preparing for the morning's march, is heard for miles around; though the true Maherry seldom growls, and it is said there are breeds which have entirely lost this disagreeable peculiarity; yet, in general, silent as is the march of a burden caravan, its halts are very unmistakeably announced to all wanderers within a long distance of its track. So harsh indeed is the growl of the Camel that Father Huc gravely declares that his Camel-driver on one occasion put a pack of wolves to flight by tweaking his Camel's nose till he roared again!

Mr. Marsh confirms the usual accounts of the temperate habits of the Camel—a quality on which his great value chiefly depends:—by means of the nutriment derived from the absorption of the hump, and the fluid preserved in and perhaps also secreted by the water-sac, he is able to travel several days without any new supplies of either meat or drink. The period of abstinence depends upon the temperature and season, the breed, training, and habits of the particular animal, and the amount of labour demanded of him.

With respect to food, there is no doubt that the Camel sometimes endures two, three, and even more days of entire privation; but long abstinence from food is seldom necessary, because, although there are well-attested instances of the existence of tracts of desert frequently crossed by caravans, six days' journey in width, and absolutely without a particle of vegetation, yet there are few portions of the Libyan or Arabian Deserts where more or less of the shrubs on which the Camel feeds do not occur at very much shorter intervals.

On the ordinary routes, therefore, the camel is not fed at all, even on long journeys, but is left to snatch his food as he can during the march of the caravan, or gather it more leisurely while he halts. In a journey of seven weeks which Mr. Marsh made with these animals in Arabia Petræa, in the months of May and June, only a single Camel of the caravan received any food from his driver. This was a fine large animal bred by the Ahabdah Arabs, which was fed at every evening halt with from a pint to a quart of beans. His habit of feeding as he walks is a serious inconvenience to the traveller. At the commencement of the day's march, he is ever on the look-out for the stunted acacias and other prickly plants, which, with occasionally a more succulent herb, constitute almost his sole diet; he snatches them in passing, giving you an uncomfortable jerk as he turns to seize them; or he suddenly stops, at some hazard of throwing you over his stooping shoulders, and, in spite of your most urgent persuasives, browses at his leisure.

The statements of travellers differ very considerably with regard to the quantity of solid food required by the Camel. Mr. Marsh's own observations would lead him to think it

extremely small. The keeper of the herd at Pisa stated that when fed entirely on hay, the Camel consumes little more than half as much as the horse; while, on the other hand, a correspondent in the Crimea informed Mr. Marsh that the Bactrian Camel requires at least fifty pounds of hay per day in Winter; and another in Bessarabia estimates the daily Winter supply of hay and straw at seventy pounds. Pottenger states that although the camels of Beloochistan can almost wholly dispense with food for five or six days together; yet they ordinarily receive about fifteen pounds of meal daily, beside grass and shrubs; and he adds the singular fact that the Belooches give these animals considerable quantities of opium and *goor*, a kind of inspissated molasses, with their food. Burckhardt says that the Berber traders give their camels twelve pounds of dhourra every two or three days; and that, when loaded with burdens of six or seven hundred pounds, they require a daily allowance. The Turkmans, according to the same authority, give their beasts every evening a ball of barley-meal, kneaded with water, and weighing about one pound. The difference in this case is no doubt occasioned by the comparative scarcity and abundance of green fodder; and it may be considered on the whole as established that the Camel thrives and labours with a less proportionate supply of nutriment in quantity, and that too of a coarser and cheaper quality, than is required by any other domestic quadruped.

The power of the Camel to abstain from water is much more severely tested than his ability to dispense with food. He is patient under thirst; but Lieutenant Burnes tells us, it is a vulgar error to believe that the Camel can live any length of time without water: he generally pines and dies

on the fourth day; and, with great heat, will even sink sooner. The testimony of travellers, as well as of native observers, on this subject varies widely; but their discrepancies can generally be explained by difference of breed, of season, or by the greater or less succulence of the solid food consumed by the animal.

The Camel, with his slender and shrunken limbs, his light quarters, and his shambling gait, seems little adapted to the performance of any labour requiring either speed or strength; but his powers of endurance enable him to accomplish a long journey in a shorter space than even the horse; and he bears a burden greatly disproportioned to his own weight. The Camel of the great Arabian Peninsula, though remarkable for his speed, is less powerful than the Bactrian, the Turcoman, the Syrian, or the Egyptian animal. In Arabia Petræa, his load does not ordinarily exceed three or four hundred pounds. Brown estimates the burdens of the Camels of Soudan at the same weight; and Burckhardt that of the Nubian Camel at four or five hundred pounds. In India, according to Forbes, his proper burden is five hundred pounds, though some powerful animals may carry from six hundred to seven hundred. Fraser states his load in Khorasan at from four hundred and fifty to seven hundred pounds. Col. Chesney found the loads of a caravan of several hundred Camels, in the Syrian desert, to average five hundred and fifty pounds; though he elsewhere states their common burden to be six hundred.

In Algeria the Camel carries four hundred and fifty to six hundred and seventy-five pounds; at Cairo, according to Burckhardt, fifteen hundred pounds for a distance of three miles, and one thousand from Cairo to Suez, which is eighty-four

miles. In Cabul, according to General Harlan, the burden of the Arabian Camel is, upon the plains, four hundred pounds; that of the cross between the Bactrian and Arabian, under similar circumstances, six hundred, and over mountainous roads four hundred pounds. In European Turkey, the one-humped Camel is said to carry from four to five hundred pounds; and Burnes estimates the load of the same animal in Bokhara at five hundred pounds. The burden of the Turcoman Camel, according to Burckhardt, is eight hundred pounds; Forbes rates it from seven hundred to one thousand, Fraser one hundred pounds higher, and Tavernier at one thousand; and, for short distances, even fifteen hundred. Timkovski states the burden of the Bactrian of Northern Tartary at from four hundred and twenty to four hundred and eighty pounds; Erman, at about six hundred pounds. Burnes estimates that of the same animal in Bokhara at six hundred and fifty pounds; and Bergmann, among the Calmucks, at eight hundred.

Purchas, the old traveller, says, "Of Camels there are three kinds: the first called Hajuin, of tall stature, and able to carry a thousand pounds weight; the second less, having a double hunch, fit for carriages to ride on, called Becheti, bred only in Asia; the third sort called Raguahill, small, able to travel (for they are unfit for burthens) above a hundred miles a day. The King of Timbuctoo can send messengers on such Camels to Segelmess or Darha, nine hundred miles distant, in the space of eight days at the farthest." He further states that such enduring swiftness would be almost incredible, were it not corroborated by the best authorities, who all agree in their accounts of the speed of the Heirie, or Maherry of the Desert—Purchas's Raguahill. "When thou shalt meet a

Heirie," say the Arabs, in their poetical mode of expression, "and say to the rider, *Salem Aleik*, ere he shall have answered thee *Aleik Salem*, he will be afar off, and nearly out of sight, for his swiftness is like the wind." The "Sabayee," said to be the fastest of the swift Dromedary breed, will, it is asserted, perform a journey of thirty-five days caravan travelling (about eighteen miles a day) in five days, accomplishing six hundred and thirty miles in that short period of time. Riley often travelled on a Dromedary at the rate of seven or eight miles an hour for nine and ten hours a day. Lyon says that the Maherry of the Northern African Arabs will continue a long trot of nine miles an hour for many hours together: and it has been asserted that a Bedouin carried a letter upon a Maherry in four days from Cairo to Mecca, a distance of at least six hundred miles.

Still, the swiftness of the Dromedary is but great in comparison with the heavy Camel of the caravan, or the baggage-Camel, which may be compared to the dray-horse; the Dromedary to the hunter, and in some instances, to the race-horse.

Burckhardt tells us that Camels travel in a single file, because if any of the loads fall out of order, they can be adjusted by leading the Camel out of the line, before those behind have come up; whereas, if they marched with a wide-extended front, the whole caravan must stop when any accident happens to a single Camel.

That the Camel was a native of Asia from the earliest times, and the great Oriental commercial vehicle of ancient, as it is of modern days, cannot be doubted. We trace it repeatedly in the Scriptures. Thus, when Joseph's brethren had cast him into the pit, and after the commission of their crime,

had sat down to eat bread, "they lifted up their eyes and looked, and, behold, a company of Ishmaelites came from Gilead, with their camels bearing spicery and balm and myrrh, going to carry it down to Egypt." (Gen. xxxvii. 25.) Again, in Judges viii. 21, we read that "Gideon arose, and slew Zeba and Zalmunna, and took away the ornaments that were on their camels' necks." In Genesis xxxii. 7, we find that Jacob "divided the people that was with him, and the flocks, and herds, and the camels, into two bands:" and the domestic state of the animal at this early period is further proved by verse 15 of the same chapter, where we see, as part of the presents sent by Jacob to propitiate Esau, "thirty milch camels with their colts." In Leviticus xi. 4, the Camel is enumerated among the forbidden animals, "because he cheweth the cud, but divideth not the hoof: he is unclean unto you." Part of Job's substance (i. 3) consisted of three thousand Camels; and Camus notices that Aristotle observes there to have been persons who have possessed as many as three thousand Camels, the precise number of Job's. The third messenger of evil informs Job that "the Chaldeans made out three bands, and fell upon the camels, and have carried them away." When, after his afflictions, the Lord blessed the latter end of Job more than his beginning (xlii. 12), "six thousand camels" formed a portion of the blessing.

And here we may observe, that though the inquiry has been the subject of much research, there is no satisfactory evidence of the existence of the Camel in an originally wild state at any period whatever. Diodorus and Strabo, indeed, mention its existence in such a state in Arabia; and Desmoulins, who has written most reliably on the subject, asserts that it so existed in the time of Hadrian: the natives, too,

of Central Africa maintain, it is said, that the animal is to be found wild in the mountains where Europeans have never penetrated. But it is far from improbable that these wild Camels might, like wild horses of the American prairies, have owed their parentage to Camels which had escaped from the control of man. Cuvier, in relating the report of Pallas upon the evidence of the Bucharians and Tartars, that there are wild animals in the deserts of the middle of Asia, well remarks that it must not be forgotten that the Calmucks give liberty to all sorts of animals from a religious principle.

We have some interesting chronicles of the use of Camels by the Franks in Gaul. In the year 585, the treasures of Mummolus and the friends of Gondovald were carried from Bordeaux to Couvennes on camels: the troops of Gontram who were pursuing them, found the camels heavily laden with gold and silver, the horses having been left exhausted on the road. And, after Brunichild had fallen into the hands of Clotair, she was, before her death, conducted through the army on a camel. It is uncertain by what people Camels were first brought into Gaul—by the Romans; by the Visigoths, or by the Franks themselves?*

* Notes and Queries, No. 26.

XII.

WONDERS OF THE WHALE.

THE Whale, as the largest animated form in existence, or, as our great Lexicographer phrases it, "the largest of the animals that inhabit this globe," is, from this characteristic alone, calculated to excite our special wonder. Vastness in the works of creation is ever impressive; but in the case of the Whale, in addition to gigantic size, the economy of the animal is throughout of an extremely interesting character.

It is now generally known that to call the Whale a Fish is a popular error. Yet his abode is in the sea, and he so resembles a fish in external appearance, that it is hardly to be wondered at that not only the vulgar, but even some of the earlier zoologists, looked upon it as belonging to that class. This notion is kept alive to the present day in the announcements of the comparative success of those ships which are employed in the *Whale Fishery;* for not only is it conveyed by that general term for the capture of Whales, but by statements that one ship has arrived with three *fish*, another with four *fish*, a third with one *fish*, &c. The error was evidently general in Dr. Johnson's time; for, in his *Dictionary* he defines the Whale as "the largest of fish."

This commonly received opinion that the Whale was a fish was, doubtless, fostered by examples in the Old Testa-

ment. In Barker's Bible (1615) the passages are: Jonah (i. 17), "Now the Lord had prepared a great fish to swallow up Jonah; and Jonah was in the body of the fish three days and three nights;"—Job (vii. 12), "Am I a sea or a whale-fish that thou keepest me in ward?"—Ezekiel (xxii. 2), "Thou art like a lyon of the nations, and art as a dragon in the sea;" in a note, "*or whale*" is added:—Matthew (xii. 40), "For as Jonas was three days and three nights in the whale's belly," &c.

In the version now used in our churches, the passage in Jonah is verbatim the same as in Barker: that in Job is thus rendered, "Am I a sea, or a whale, that thou settest a watch over me?"—that in Ezekiel, "Thou art like a young lion of the nations, and thou art as a whale in the seas:"—that in Matthew is identical with the passage in Barker.

The Rev. Dr. Scot, of Corstorphine, has shown to the Wernerian Society that the great fish which swallowed up Jonah could not be a Whale, as often supposed, but was, probably, a white shark.

We next see how far the old naturalists differed. Pliny expressly states that neither Whales nor dolphins have gills, like fishes, but breathe by means of blow-holes, which appertain to the lungs. Aristotle, whose great zoological work Pliny had closely studied, was certainly aware of the broad distinction between the Whales and dolphins and fishes. Gesner separated the Whales from the fishes, including them in a distinct order of marine animals. Ray contends that no other animals can be justly termed fishes except those which breathe by means of gills, and have but one ventricle to the heart. He adds, that if we speak properly and philosophically, the name of fish should be restricted to such animals

only; he points out the absence of any relationship of the Cetacea, or Wales, with the true fishes, adding, that with the exception of the place where they spend their lives, the external figure of their body, their hairless skin, and their natatory progression, they have scarcely anything in common with the true fishes, but in other respects agree with the viviparous quadrupeds. Linnæus next detached the Cetaceans from the fishes, and associated them with the mammals, thus no longer yielding to popular prejudice by calling that a fish which he knew to be a mammiferous animal, the order being thus defined by its great founder: Spiracles upon the head: pectoral fins and horizontal caudal fin without claws.

Cuvier defines Cetaceans to be mammiferous animals without posterior feet: they remain constantly in the water; but as they respire by means of lungs, they are obliged to come frequently to the surface for air. Their warm blood; their ears open externally; their viviparous generation; the teats by means of which they suckle their young; and all the details of their anatomy; sufficiently distinguish them, Cuvier observes, from the fishes. The herbivorous Cetaceans leave the water to creep and feed on the bank, which, when they have been seen from a distance, with their heads raised vertically out of the water, have given them some resemblance to women or men, and have probably given rise to the stories of some travellers, who pretend that they have seen Tritons and Syrens. The breast fins have been called *hands*, because, instead of being composed of straight spines, like those of fishes, they conceal bones and muscles formed very like the fore-legs of land animals; but so enveloped in dense skin, that the fingers have no separate motion, though the *hand* is very flat, very pliant, large, and strong, enabling the

Whale to sustain the young closely compressed to its body, as was remarked by Aristotle. Its fins, or swimming-paws, serve as a helm rather than as oars, because they then lie flat on the surface of the water, and are not instrumental in producing its motion, which arises entirely from the tail; its form also obliges them to move it from above downwards for their progressive motion, and aids them greatly in raising themselves in the water. The tail consists of two beds of muscles, connected with an extensive layer surrounding the body: it is only four or five feet long, but more than twenty feet broad, and a single stroke will throw a large boat with its crew into the air. The fins have great spring and vitality: De Reste states that they continue to move for some time after being separated from the body. One proof of the great age of the Whale is the cartileges of their side fins, or hands, being perfectly ossified, or converted into bone, as is the case in very old Whales.

The ordinary Cetaceans have, on the head, blowing-holes, which serve for respiration, and getting rid of the large volumes of water which are taken with their prey into their very spacious mouth: this outlet passes across the nostrils, and is collected in a sac placed at the external orifice of the cavity of the nose, whence it is driven out with violence by the compression of powerful muscles by a narrow aperture placed at the top of the head. The Rev. Mr. Scoresby, however, maintained that these blowing-holes emit only a moist vapour, and are huge nostrils, but other naturalists have seen them spout water when within a few yards of them; and this discrepancy may be explained by some species spouting more than others. When this vehement breathing or blowing is performed under the surface, the Whale produces those *jets*

d'eau which cause them to be seen from afar by voyagers. Scoresby describes the sound thus occasioned as the only similitude of a voice emitted by the animal; adding that, in the case of a violent respiration, it resembles the discharge of a cannon! The nostrils being incessantly traversed by floods of salt water, could not be lined with a membrane sufficiently delicate for the perception of odours; and if any Whales enjoy the sense of smelling, they must have it very much obliterated.

It may be here explained further, that the water when once in the sacs, or reservoirs, can be there retained until the animal wishes to spout, when it closes the valve, and so prevents the descent of the water into the nasal passages, and forcibly compresses the sacs by means of the muscular expansion which overspreads them. The water, compelled thus to escape by the narrow semilunar apertures, is projected to a height which corresponds to the amount of the pressure applied.

With reference to the term "spouting," Mr. Brierly, the marine painter, who has seen much of the operation in the Southern Seas, maintains "that the Whale never really spouts water from the head in the manner generally represented: the air, as it rushes up through the blow-holes, takes up a portion of water, which is blown up, like a jet of steam; the only fluid ever spouted from the head is blood when the animal is severely wounded internally by lancing; this frequently rises in two great columns, and is spread by the wind in a shower over the men and boats near: he is then said by the whalers to have 'his chimney a-fire.'"

The Baleen, improperly termed Whalebone, is the produce of the Mysticete, or Whalebone Whale, whose palate is

covered with the baleen, in the form of sub-triangular plates, that he may strain the water, which he takes in with his large mouth, and retain the small animals on which he subsists. The baleen has the free edge fringed towards the mouth, the fixed edge attached to the palate, the broad end fixed to the gum, and the apex to the inside arch; the plates being placed across each other at regular distances. The use of the baleen is principally for the retention of the food till swallowed. This Whale was formerly thought to increase the number of vertebræ with its growth; but Mr. Gray has proved this to be a mistake.

Sometimes eight hundred blades of baleen are found in a full-grown Whale. Seeing that the *head* furnishes the baleen, the record of an ancient perquisite of our Queens Consort evinces gross ignorance of the economy of the Whale. This privilege was that on the taking of a Whale on the British coast, it should be divided between the King and Queen, the head only being the King's property, and the tail the Queen's. The reason of this whimsical distinction, assigned by our ancient records, was to furnish the Queen's wardrobe with whalebone. The blades of baleen vary from eight to twelve feet in length, and the Mysticete produces the best and largest kind. It is extensively used in the manufacture of stays and umbrellas; in shavings for plaiting like straw, light hats and bonnets; in crinoline; and in covering whip-handles, walking-sticks, and telescopes.

The anatomy of the vast creature is full of wondrous interest. John Hunter well observes, "that in our examination of particular parts, the size of which is generally regulated by that of the whole animal, if we have been only accustomed to see them in those which are small, or middle-

sized, we behold them with astonishment in animals so far exceeding the common bulk as the Whale. Thus," adds Hunter, "the heart and aorta of the Spermaceti Whale appear prodigious, being too large to be contained in a wide tub, the aorta measuring a foot in diameter. When we consider these as applied to the circulation, and figure to ourselves that, probably, ten or fifteen gallons of blood are thrown out at a single stroke, and moved with an immense velocity through a tube of a foot diameter, the whole idea fills the mind with wonder." Paley compared the aorta of a Whale, with the blood rushing through it, to the water passing through the middle arch of old London Bridge. The imagination is overwhelmed with the aggregate of the quantity of blood that must pass through the heart of the Leviathan of the deep in twenty-four hours. It is a general law that the pulse of the larger animals is lower than that of the smaller; but even if we put the pulse of the Whale as low as twenty in a minute, the quantity circulated through the heart, calculated at fifteen gallons for each pulsation, will be 432,000 gallons, nearly equal to 7,000 hogsheads in twenty-four hours!

The consideration of this amazing quantity is, however, a subject of mere empty wonder, if not accompanied with the reflection, that, in order to produce the aggregate amount, the heart is kept in constant motion; and that, in fact, it is incessantly *beating*, as it is termed, or throwing out the blood in the arteries, from the first period of existence to the moment of death, without any sensation of fatigue.

But the most remarkable portion of the almost infinite circumvolution of arteries in the Whale is the wonderful network which enables the animal to remain under water for

more than an hour. Hunter was the first who determined its exact nature, and showed it to be a reservoir of arterial or aerated blood from which the brain and nervous system derive their stimulus. The veins are remarkable not only for their great capacity, but also for their number, and the immense network which they form in different parts of the body; and above all, for the almost total absence of valves, which, and the pressure of the sea-water at the depths to which Whales retreat when harpooned, explains the profuse and deadly hæmorrhage (such as that observed by Mr. Brierly, at page 263) which follows a wound that would in other Mammalia be by no means fatal. Professor Owen first gave this illustration, which clears up the difficulty that must have occurred to most, of accounting for the fact of so enormous an animal as the great Whale being killed by such puny instruments as the harpoon and lance.

In the case of the Spermaceti Whale, it appears to occupy about a seventh of its time in breathing; and when it rises, after long intervals, an enormous quantity of air must rush into the lungs, and create a vast quantity of blood for the reservoir described by Hunter. In ordinary mammals, man and the quadrupeds for instance, respiration is momentarily going on, and enough air only is inhaled to oxygenate the blood requisite for the pulsations. The Whale's Brain is well-formed, but small: in the greater kinds there is reason for supposing that the ratio of the weight of the brain to that of the body is $\frac{1}{3000}$; in the smaller Cetaceans it is not diminished to a proportionate size. The sense of hearing in Whales appears to be fairly developed; and Whale fishers experience no small difficulty from the warning given by both eye and ear. It has, however, been stated that the

Greenland Whale, though not without a nice sense of hearing, remains insensible to the report of a cannon.

This Whale is seen in the greatest numbers in the "green water" of the Greenland sea, because of the incalculable number of medusæ or animalcules in these waters, of above 20,000 square miles. The Whale cannot derive any direct subsistence from the animalcules; but these form the food of other minute creatures, which then support others, till at length animals are produced of such size as to afford a morsel for their mighty devourer. Scoresby estimates that two square miles of these waters contain 23,888,000,000,000,000 animalcules; and as this number is beyond the range of human words and conceptions, he illustrates it by observing that 80,000 persons would have been employed since the Creation in counting it!

In November, 1827, an immense specimen of the Greenland Whale was found floating off the coast of Belgium, about twelve miles from Ostend, by a crew of fishermen: their boat being of too weak tonnage and sail to move so enormous a mass, they hailed two other boats to their assistance, and the three together towed the Whale towards Ostend harbour, on entering which the cable with which it was fastened to the boats, broke, and the Whale was cast on the sand east of the harbour, where the dissecting, cleaning, &c. were effected. The dimensions, weight, &c. were thus stated:—

	Feet.
Total length of the Whale	95
Breadth of the same	18
Length of the Head	22
Height of the Cranium	4½
Length of the Vertebral Column	69½
Number of the Vertebræ	62
Number of Ribs, 28, each in length	9
Length of the Fins	12½

	Feet.
Length of the Fingers	4½
Width of the Tail	22½
Length of the Tail	3

Weight of the Whale when found, 249 tons, or 480,000 lbs.
Weight of the skeleton only, 35 tons, or 70,000 lbs.
Quantity of oil extracted from the blubber 4000 gallons.
Weight of the flesh buried in the sand, 85 tons, or 170,000 lbs.

The skeleton was mounted upon iron supports, and exhibited in a pavilion at Ostend; next at Paris, in Place Louis XV.; and in 1831, upon the site of Trafalgar Square, Charing Cross. The skeleton was placed in the area of the pavilion, and within the ribs was a gallery, to which visitors ascended by a flight of steps.

The length of this Whale exceeded the utmost credited by Scoresby, which he states at 70 feet; and Beale describes a Sperm Whale of 84 feet.* Of 322 Whales, in the capture of which Scoresby was concerned, none exceeded 58 feet: even 60 feet implies a weight 70 tons, being nearly that of 300 fat oxen. Of this vast mass, the oil in a rich Whale composes about 30 tuns, and when, as was the case some years ago, that article brought *55l.* or *60l.* per tun, we may form some idea of the great value of the capture.

The capture of Whales in localities where they have been little expected, has been an interesting event for the Chroniclers. In the *Liber de Antiquis Legibus*, we read "That on Sunday in the beginning of Lent, in the second year of King Edward (II. 1308–9), a Whale was taken in the Thames, near Grenewis (Greenwich), being 12 toises in length, and 5 toises in girth; and it was brought to the Tower of London, and there cut up by the Constable, Sir John de Cromwelle, acting for the King."

* The Rorqual, 100 feet in length, is the largest animal. See p. 39.

In the year 1391, as Stow tells us: "A Dolphin came forth of the Sea, and played himself in the Thames at London to the Bridge; foreshewing, happily, the tempests that were to follow within a weeke after; the which Dolphin being seene of citizens, and followed, was, with much difficulty, intercepted, and brought again to London, shewing a spectacle to many of the heighte of his body, for he was tenne foote in length. These Dolphins are fishes of the Sea, that follow the voices of men, and reioyce in playing of instruments, and are wont to gather themselves at musick. These, when they play in rivers, with harty springings or leapings, doe signifie tempests to follow. The seas contain nothing more swift nor nimble, for oftentimes with their skips, they mount over the sailes of ships." Walsingham relates this story, with many more particulars concerning Dolphins.

Evelyn, in his *Diary*, June 30, 1658, records "the killing of a large Whale, near his seat at Sayes Court, between Deptford and Greenwich." "It appear'd first below Greenwich at low water, for at high water it would have destroyed all y^e^ boates; after a long conflict it was kill'd with a harping yron, struck in y^e^ head, out of which spouted blood and water by two tunnells, and after an horrid grone, it ran quite on shore, and died. Its length was 58 foote, height 16; black skin'd like coach leather, very small eyes, greate taille, onely 2 small finns, a picked snout, and a mouth so wide that divers men might have stood upright in it; no teeth, but sucked the slime onely as thro' a grate of that bone which we call whale-bone; the throate yet so narrow as would not have admitted the least of fishes."

The remains of Whales figured in the old museums;

among the rarities of the Royal Society at Gresham College were the vertebra of a Whale, weighing nearly 30 lbs; and part of the ear-bone of a Whale, as big as a labourer's fist, and hard as any bone. Wormius mentions 22 kinds of Whales, and the last "liker an island than an animal."

Rackstrow's Museum, in Fleet Street, now No. 195, had some time for its great attraction, the skeleton of a Whale, more than 70 feet long.

Among the habits of the Whales, affection for their young is striking. The Manatees are gregarious, and generally go in troops. The young are usually placed in the centre of the herd for protection, and on the approach of danger, all unite for the common safety. It is alleged that, when one has been struck by a harpoon, its companions will tear out the weapon; and they are so attached to their young, that if the calf be taken, the captors are sure of the mother, from the recklessness with which her maternal affection leads her to the place of capture. If the mother be captured, the young follow her to the shore, and fall an easy prey. At St. Domingo, a party of hunters, in a small boat, approached a shoal of Manatees, and struck at them with a harpoon, to which a long stout cord was made fast. The stricken animal made violent efforts to escape, carrying with it the harpoon and cord, to the end of which a cork or piece of light wood to serve as a buoy was attached, and indicated the whereabouts of the manatee. After a while the hunters took hold of the rope, and at last drew the exhausted animal ashore, where it was killed. The sport of manatee-catching, thus conducted, is described as highly diverting; but the boat is sometimes upset by the struggles of the animals in the shoals.

The Dugong presents another instance: it is caught by

spearing, during the night; or sometimes shot at the end of a musket. The female Dugong produces generally only one young at a birth, and to this the mother bears such strong affection that, if the young is speared, the mother will not depart, but is sure to be taken also. The Malays consider this animal as almost typical of maternal affection. The young utter a short and sharp cry, and are said to shed tears, which are carefully preserved by the common people as a charm, under the notion that they will secure the affections of those whom they love, as they attract the mother to the young Dugong.

The Dugong is considered by the Malays as a royal fish, and the king has a right to all that are taken; just as in England the Sturgeon is the royal fish, "because, by a statute of Edward II. it is said, the king shall have sturgeon taken in the sea, or elsewhere, within the realm."

The Dugong of the Red Sea is described by Professor Rüppell as *tabernaculis*, under the impression that it was with the skin of this species that the Jews were directed to veil the Tabernacle. The Arabs state that these Dugongs live in pairs or small families, that *they have feeble voices*, and that in February and March bloody battles occur between the males, which attain the length of 18 feet.

The Porpesse also watches over her young with the most tender care. Porpesses frequent our shores, and two have been seen sporting in the Thames, above London Bridge, regardless of the steamboats which were constantly passing. They swim in shoals, and drive the mackerel, herrings, and salmon before them, pursuing them up bays "with the same eagerness," says Pennant, "as a pack of dogs does a hare." Those who have seen the Porpesse in pursuit of the salmon,

describe the scene as very exciting from the efforts of the salmon to escape, and the adroitness of its pursuer. In their distress, the salmon frequently spring high out of the water, but their ever-watchful foe bides their relapse, and by its rapid, quick, and well-defined turns, seldom fails to secure its prey. A Beluga, or White Whale, haunted the Frith of Forth, in the summer of 1815, for nearly three months, passing almost daily upwards, and again retiring with the flood and ebb. It was supposed to be in pursuit of salmon; and after many unsuccessful attempts, the salmon-fishers killed it with fire-arm and spears. The tail of this Whale is powerful, and, bent under the body in swimming, propels the animal with the velocity of an arrow.

Mr. Brierly tells us that the most important natural enemy of the Whale on the coast of Australia is the "killer," a large kind of porpoise, with a blunt head and large teeth. These "killers" often attack the Whale, and worry it like a pack of dogs, and sometimes kill it. The whalemen regard these creatures as important allies, for when they see from the look-out that a Whale has been "hove to" by them, they are pretty sure of capturing it. The killers show no fear of the boats, but will attack the Whale at the same time; and if a boat is stove, which often happens, they will not hurt the men when in the water. The Australian natives about Twofold Bay say, the killers are the spirits of their own people, and when they see them will pretend to point out particular individuals they have known; some are very large, exceeding twenty-five feet; they blow from the head in the same manner as the Whale.

The localities of Whales have been much disputed. Where the Northern Whale breeds has long been a puzzling ques-

tion among whalemen. It is a cold-water animal. Maury asks: "Is the nursery for the great Whale in the Polar Sea, which has been so set about and hemmed in with a hedge of ice that man may not trespass there? This providential economy still further prompts the question, Whence comes the food for the young Whales there? Do the teeming waters of the Gulf-Stream convey it there also, and in channels so far down in the depths of the sea that no enemy may waylay, and spoil it in the long journey?"

It was generally believed that the Northern Whale, which is now confined to the Polar Sea, descended annually into the temperate regions of the Atlantic, as far as the Bay of Biscay, and that it was only the persecution of the whale-fishers which compelled it to seek its frozen retreat. This opinion is now shown to be erroneous, and to have rested only on the confounding of two distinct species of Whale. Like other Whales, the Northern is migratory, and changes its quarters according to the seasons; and the systematic registers of the Danish colonists of Greenland show that often the same individual reappears at the same epoch, in the same fiord. The females of the Southern Whale visit the coast of the Cape in June, to bring forth their young, and return to the high seas in August or September. It was supposed that the migration of the Northern Whale was for a similar purpose. This, however, is not now considered to be the case. Its movements are attributed to climatal changes alone, and especially to the transport of ice into Baffin's Bay. It lives entirely in the midst of glaciers, and, therefore, is found in the south during winter, and in the north during summer. The whale-fishery has diminished its numbers, but not altered its mode of life. It is stated now that the Whale believed to

have visited the North Atlantic Ocean is a totally different species,—a much more violent and dangerous animal than the Northern Whale, also smaller and less rich in oil. The fishery for the latter ceased towards the end of the last century; but it is thought to be not wholly extinct. On September 17, 1854, a Whale, with its little one, appeared before St. Sebastian, in the Bay of Biscay: the mother escaped, but the young one was taken, and from a drawing of the skeleton of the latter, MM. Eschricht and Reinhardt, of Copenhagen, are convinced that it belonged to a species distinct from the Greenland Whale: so that the name Mysticete has been applied to various Whales.

The Sperm Whale, says Maury, is a warm-water animal. The *right* Whale delights in cold water. The log-books of American whalers show that the torrid zone is to the right Whale as a sea of fire, through which he cannot pass; that the right Whale of the northern hemisphere, and that of the southern, are two different animals; and that the Sperm Whale has never been known to double the Cape of Good Hope—he doubles Cape Horn.

Mr. Beale has done more to elucidate the habits and form of this Whale than any other writer.* Its great peculiarity of form is the head, presenting a very thick, blunt extremity, constituting about a third of the whole length of the animal. The head, viewed in front, has a broad, flattened surface, rounded and contracted above, considerably expanded on the sides, and gradually contracted below, resembling in some degree the cutwater of a ship. On the right side of the nose is a cavity for secreting and containing an oily fluid, which, after death, concretes into the substance called spermaceti, of

* Natural History of the Sperm Whale, 1839.

which, in a large Whale, there is not unfrequently a ton. The mouth extends nearly the whole length of the head; and the throat is capacious enough to give passage to the body of a man, presenting a strong contrast to the contracted gullet of the Greenland Whale. Immediately beneath the black skin of the Sperm Whale is the blubber, or fat, termed "the blanket," of a light yellowish colour, producing, when melted, the sperm oil. A specimen, taken in 1829, near Whitstable, measured 62 feet in length; the oil was worth 320*l*., exclusive of the spermaceti.* Many years since, the *Samuel Enderby* whaler returned from the south with a cargo of sperm oil worth 40,000*l*.

This Whale swallows quantities of small fishes, and one has been known to eject from its stomach a fish as large as a moderate-sized salmon: its principal food is squids, or cuttle-fishes. This species is gregarious; and the herds, called "schools," are females and young males. Mr. Beale has seen 500 or 600 in one school. With each female school are from one to three large "bulls," or "schoolmasters," as they are termed by the whalers. The full-grown males almost always go in search of food. A large Whale will yield eighty, and sometimes one hundred barrels of oil. Among the habits of this Whale are "breaching," or leaping clear out of the water, and falling back again on its side, so that the breach may be seen in a clear day from the mast-head, at six miles distance; in "going a-head," the Whale attains ten or twelve miles an hour, which Mr. Beale believes to be its greatest velocity; "lob-tailing" is lashing the water with

* Formerly, when spermaceti was only used as medicine, many tons of it were annually thrown into the Thames as useless, the supply being so much in excess of the demand.

its tail; the dangers and hair-breadth escapes in the capture are very numerous.

In 1839, there were discovered among rubbish, in a tower of Durham Castle, the bones of a Sperm Whale, which, from a letter of June 20, 1661, in the Surtees collection, is shown to have been cast ashore at that time, and *skeletonized* in order to ornament this old tower. Clusius describes, in 1605, a Sperm Whale thrown ashore seven years before, near Scheveling, where Cuvier supposed its head to be still preserved—for there is an antiquity of the kind still shown there.

The Whale Chase is an exciting scene. Sometimes the Whale places himself in a perpendicular position, with the head downwards, and rearing his tail on high, beats the water with awful violence. The sea foams, and vapours darken the air; the lashing is heard several miles off, like the roar of a distant tempest. Sometimes he makes an immense spring, and rears his whole body above the waves, to the admiration of the experienced whaler, but to the terror of those who see for the first time this astonishing spectacle. Other motions, equally expressive of his boundless strength, attract the attention of navigators, at the distance of miles.

The whole structure of the Whale exhibits most admirable adaptation to his situations and the element in which he lives —in the toughness and thickness of his skin, and disposition of the coating of blubber beneath, which serves the purpose —if we may be permitted to use so homely a simile—of an extra great-coat to keep him warm, and prevent his warm, red blood from being chilled by the icy seas. But provision is especially made to enable him to descend uninjured to very great depths. The orifices of the nostrils are closed by valves

wonderfully suited to keep out the water from the lungs, notwithstanding the pressure. In one species they are shaped like cones, which fit into the orifice like corks in the neck of a bottle, and the greater the pressure the tighter they hold.

The most surprising fact in the Whale, probably, is the power of descending to enormous depths below the surface of the sea, and sustaining that almost inconceivable pressure of the superincumbent water. On one occasion, which fell under Mr. Scoresby's own observation, a Whale was struck from a boat. The animal instantly descended, dragging down with him a rope very nearly *one mile long*. Having let out thus much of the rope, the situation of the boat's crew became critical—either they must have cut the line, and submitted to a very serious loss, or have run the risk of being dragged under water by the Whale. The men were desired to retire to the stern, to counterbalance the pulls of the Whale, which dragged the bow down sometimes to within an inch of the water. In this dangerous dilemma the boat remained some time, vibrating up and down with the tugs of the monster, but never moving from the place where it lay when the harpoon was first thrown. This fact proves that the Whale must have descended at once perpendicularly, as had he advanced in any direction, he must have pulled the boat along with him. Mr. S. and the crew were rescued by the timely arrival of another boat, furnished with fresh ropes and harpoons.

A Whale when struck, will dive sometimes to a depth of 800 fathoms; and as the surface of a large animal may be estimated at 1,500 square feet, at this great depth it will have to sustain a pressure equal to 211,000 tons. The transition from that which it is exposed to at the surface, and

which may be taken at about 1,300 tons, to so enormous an increase, must be productive of the utmost exhaustion.

Strange incidents are related of harpooning. In September 24, 1864, as the *Alexander*, belonging to Dundee, was steaming about in Davis's Straits, a Whale of about twelve tons was observed not far distant from her. Boats were put out, and the crew secured the animal. When they cleansed it, they found imbedded in its body, two or three inches beneath the skin, a piece of a harpoon, about eighteen inches long: on one side were engraved the words, "Traveller, Peterhead;" and on the other, "1838." This vessel was lost in 1856, in the Cumberland Straits Whale-fishery: it is, therefore, clear that the harpoon must have remained in the animal from that time.

It has been proposed, in the United States fishery, to facilitate by electricity the capture of the Whale. One or two boats are to be lowered; the electricity is conveyed to the body of the Whale from an electro-galvanic battery contained in the boat, by means of a metallic wire attached to the harpoon, and so arranged as to re-conduct the electric current from the Whale through the sea to the machine. This machine is inclosed in a chest, and is capable of throwing into the body of the Whale eight tremendous strokes of electricity in a second, or 480 strokes in a minute, paralyzing in an instant the muscles of the Whale, and depriving it of all power of motion, if not actually of life.*

Although remarkable changes have of late years taken place in the Whale-fisheries, the economy of the stupendous creatures—"mightiest that swim the ocean stream"—remains a branch of study of exhaustless interest.

* New Bedford (U.S.) Mercury, 1852.

XIII.

STORY OF THE BIG BIRD OF NEW ZEALAND.

O Englishmen there can scarcely be said to exist upon the trackless waters of the globe a more interesting region than the Islands of New Zealand. No country in the southern hemisphere is more favoured by Nature, in beautiful scenery and fertility of soil; or in its relative position to other countries, where civilization has long planted her peaceful standard; and here commerce, founded on the capital introduced from Great Britain, gives a life to the place similar to that of old countries. The parallel has, however, been carried centuries further: the popular historian, Mr. Sharon Turner, remarked, some fifty years since, "it is probable that the present state and people of New Zealand exhibit more nearly than any other country, the condition of Britain when the Romans entered it nearly eighteen centuries since."

It is to the aboriginal period in the history of New Zealand that "the Story of the Big Bird" relates. There is to this day in the Islands a small wingless bird; but there have been found in the country the bones of a gigantic bird of the same family. Hence has arisen the question—What has become of the larger birds? That they should have perished is less extraordinary than that the birds of smaller size should have become extinct. Man is the great destroyer of animal

life wherever he extends his dominion; and in this case, it is supposed that the larger and more conspicuous birds have fallen a prey, whilst the smaller birds may have concealed themselves, and escaped. Their continued existence, while the larger birds have disappeared, is the result of circumstance, which "may be illustrated by the fable of *the oak and the reed;* the smaller and feebler animals have bent, as it were, and accommodated themselves to changes which have destroyed the larger species."* The investigation of these changes and conditions has been a very interesting pursuit of naturalists for some years past.

In the noble Museum of the College of Surgeons in Lincoln's Inn Fields is a specimen of the remains of one of the larger New Zealand birds: the means by which the College obtained this valuable acquisition is thus graphically narrated by Mr. Samuel Warren, F.R.S.: "In the year 1839, Professor Owen was sitting alone in his study, when a shabbily-dressed man made his appearance, announcing that he had got a curiosity which he had brought from New Zealand, and wished to dispose of to him. It had the appearance of an old marrow-bone, about six inches in length, and rather more than two inches in thickness, *with both extremities broken off;* and Professor Owen considered that, to whatever animal it might have belonged, the fragments must have lain in the earth for centuries. At first, he considered this same marrow bone to have belonged to an ox, at all events, to a quadruped; for the wall or rim of the bone was six times as thick as the bone of any bird, even of the ostrich. He compared it with the bones in the the skeleton of an ox, a horse, a camel, a tapir, every quadruped apparently possessing a bone of that

* Zoological Transactions, vol. i. p. 387.

size and configuration; but it corresponded with none. On this he very narrowly examined the surface of the bony rim, and at length became satisfied that this fragment must have belonged to *a bird!*—to one at least as large as an ostrich, but of a totally different species; and, consequently, one never before heard of, as an ostrich was by far the biggest bird known.

"From the difference in the *strength* of the bone, the ostrich being unable to fly, so must have been unable this unknown bird; and so Professor Owen came to the conclusion that this old shapeless bone indicated the former existence, in New Zealand, of some huge bird, at least as great as an ostrich, but of a far heavier and more sluggish kind. Professor Owen was confident of the validity of his conclusions, but would communicate that confidence to no one else, until he printed his deductions in the Transactions of the Zoological Society for 1839, where, fortunately, they remain on record, as conclusive evidence of the fact of his having then made this guess, so to speak, in the dark. He caused the bone, however, to be engraved; and having sent a hundred copies of the engraving to New Zealand, in the hope of their being distributed, and leading to interesting results, he patiently waited for three years, viz. till the year 1842—when he received intelligence from Dr. Buckland, at Oxford, that a great box, just arrived from New Zealand, consigned to himself, was on its way, unopened, to Professor Owen; who found it filled with bones, palpably of a bird, one of which bones was three feet in length, and much more than double the size of any bone in the ostrich!

"And out of the contents of this box, the Professor was positively enabled to articulate, (or put together,) almost the

entire skeleton of a huge wingless bird *between ten and eleven feet in height*, its bony structure in strict conformity with the fragment in question; and that skeleton may at any time be seen at the Museum of the College of Surgeons, towering over, and nearly twice the height of, the skeleton of an ostrich; and, at its feet is lying the old bone from which alone consummate anatomical science had deduced such an astounding reality: the existence of an enormous extinct creature of the bird kind, in an island, where previously no bird had been known to exist larger than a pheasant or a common fowl!"* This remarkable identification is commemorated in a portrait of Owen, which hangs in the picture-gallery at Drayton Manor, the seat of Sir Robert Peel; the Professor being depicted holding the large bone in his hand.

The finding of some other bones which had been sent to England, and transmitted to Professor Owen, was the result of a journey to North Island, New Zealand, made by Dr. Arthur Thomson, surgeon of the 58th Regiment. He commenced his search in 1849: his guide, an old woman, had seen the bones about fifty years previously, and they as well as the place of the cave which contained them were familiar to her mind, as she had seen them when a girl; but the face of the country had much changed since that period: trees had grown up where ferns had formerly grown, and fern was now growing where trees then stood; so that, after searching about for a whole day, the old lady gave up the task, and Dr. Thomson returned to Auckland, the capital of the island, without accomplishing the object of his journey.

Seven months later, in September, 1849, Dr. Thomson

* Lecture on the Moral and Intellectual Development of the present Age, pp. 59—61. 1853.

made a second trip to North Island, when he was more successful in finding in a cave a quantity of bones of the *Moa*, the native name of the bird, named by naturalists the *Dinornis*. Among these specimens were several entire skulls, and the beaks of some of the largest birds, and a single bone. These specimens were sent to the Governor of New Zealand, who is said to have transmitted them to Professor Owen. Dr. Thomson could not however describe the cave in which the bones were found; and a native of Auckland had refused to conduct him to the cave, because the bones that were in it had been sold to an European at an extravagant price.

Dr. Thomson, however, made a third attempt to find the cave; and for this purpose, set out with Major Hume and Captain Cooper, in October, 1852; and directed their steps to Rarianiwaniwa, a village upwards of one hundred miles from Auckland, near to which the Moa cave is situated. When passing through a forest they were overtaken by a native driving a pig: they knew him to be partial to Europeans, because he had a gun-swivel hung from a hole in his right ear, as an ornament; and he had on his feet a much-worn pair of Blucher boots. They kept with him for some time, chiefly to admire how he got his pig through a most intricate path in the wood, the animal appearing to understand perfectly what he said. They entered into conversation about the price of his pig, and then asked him if he knew any cave near his village, which contained Moa's bones. This question made him stop and turn round, and look at Dr. Thomson and his companions. Now, had an English pig-driver, says Dr. Thomson, been asked when near the quarry in Tilgate Forest in Sussex, if he had ever heard of the fossil remains of the Iguanodon Hylæosaurus found on

that spot, he would most likely have inferred that the querist had escaped from a madhouse, because he was asking about things he had never heard of: not so, however, with the New Zealander, acquainted with every tree in the forest, and every insect in the ground: he at once understood the question, and replied: "I will show you a cave which contains Moa's bones, for two sticks of tobacco." The bargain was made, and Dr. Thomson and his friends, with the New Zealander as their guide, started for the country in which the caves are situated.

On the western coast of the North Island of New Zealand is an extensive limestone district chiefly composed of marine limestone; here on a level with the sea, and there rising into mountain ranges upwards of a thousand feet high, or in bold cliffs and chasms inland to the Waipa River, presenting a highly picturesque effect. The soil on this limestone formation is covered with ferns, and occasionally large dense forests of trees. There are numerous caves, and grottoes, and cells, all over the district, which have long been known to the New Zealanders in this part of the country. They call one of these caves *Te Anaotema*, or *the Cave of the Moa*. It is situated near the summit of a small hill, about a mile and a half from the village of Parianiwaniwa (in the Maori language, the precipice of the rainbow), about a thousand feet above the sea-level.

The Cave of the Moa is in a limestone hill, with two openings, one of which, fourteen feet high, was covered with trees and bushes, which the explorers had to break down before they got an entrance. The cave is 165 feet long, the greatest breadth twenty-eight feet, and the height sixty feet. The roof is oval, with stalactites hanging gracefully from it,

giving it an almost cathedral-like effect: it is something in the form of a crescent: one part of the floor is covered with calcareous spar; another with soft stalagmites; and another with earth, beneath which and the soft deposit of carbonate of lime, the Moa's bones are found. The air of the cave was colder than the atmosphere; there was not much dropping of water at the time of the explorers' visit, but it must have been very considerable at one time, to have produced the large deposit of soft limestone, in which and the fallen earth the bones were partially imbedded. It would have required several days' labour of a number of men to clear out the bottom of the cave properly; but the explorers did not see any bones of men, or other animals, except those of Moas; nor any marks of fire, sculpture, nor figures of any description on the walls of the cave. Thither the Maories were accustomed to resort to procure the skulls of the Moas, to hold the powder which they used for tattooing; and the scarcity of skulls was accounted for by their being formerly used as powder-holders: hence only four were obtained. There was nothing to indicate that the bones had been deposited in the cave by water, for there was found a remnant of almost every bone in the body. The animals evidently came to this cave to die. The bones appeared to have been exposed to the air, and some were incrusted with limestone. There were few long bones in the cave; and on the travellers asking what had become of them, they were told that they had been taken away to be made fish-hooks of, before the introduction of iron.

The second cave explored is called by the New Zealanders *Te Anaoteatua*, or the Cave of the Spirit, at about a mile from the native settlement of Rotomarama, and is situated at the bottom of a hill, in a rock, with an entrance of oval form, re-

sembling the gateway of an old castle, and concealed by thick foliage of shrubs, more especially of dark green creepers. The cave winds underneath the hill for upwards of a mile, and consists of several passages. From the top and sides there are numerous stalactites, some of transparent calcareous spar, others of a red tint. In some parts are openings in the roof from ten to fifteen feet each in circumference, through which the light streamed in, 150 feet above the head: wood and débris had been washed down from the surface, and even during day the cavern was dark. There are numerous spacious chambers, picturesque galleries, grottoes and cells, in different parts of the cave. The height of the roof varies from ten to fifty feet; in breadth, twelve to forty feet.

Dr. Thomson saw no living creature in the cave, but a few glow-worms, which, adhering to the high-domed roof, presented the appearance of the starry firmament. The Moa's bones were found in this cave, under the sand, in crevices and corners, and under the limestone floor. They were broken, and showed evidence of having been rolled, having been washed from the interior of the cave, or into the cave, by water. Dr. Thomson thinks the Moas resorted to this cave as a place of refuge. Before the introduction of Christianity, this was "the Cave of the Spirit of God," and was held in the greatest terror by all New Zealanders. Dr. Thomson adds: "The love of money made some Christian natives conquer their fears, and enter the cave three years back, to look for Moa's bones; but the examination was apparently made in a very hasty and imperfect manner. It was in such gigantic caves as this, that the richest harvest of fossil and sub-fossil bones has been found in Europe, South America, and Australia."

The Moa belongs to the Struthious family of birds, distinguished by having very short or rudimentary wings and massive legs. In their habits they are strictly terrestrial, that is, they do not leave the earth: the Ostrich, the Cassowary, and the Emeu, are existing specimens of this family with which we are familiar through the Menagerie of the Zoological Society in the Regent's Park. Bones of five different species of Moas have been found in New Zealand: the scientific term Dinornis is applied to the whole of them. There are also found in New Zealand, side by side with the large Moa's bones, the bones of other birds, nearly allied, though of less magnitude. The smallest is called the Notornis, a specimen of which was caught alive, in a remote, unfrequented part of the South Island of New Zealand, in 1850, by some sealers, and kept alive for several days, and afterwards killed and eaten; but fortunately the skin of this interesting bird, the link between the living and the dead, the last perhaps of a race coeval with the gigantic Moas, was preserved from destruction by Mr. Walter Mantell, Commissioner of Crown Lands, Wellington.

The largest species of Moa is supposed to have stood ten feet six inches in height; but Dr. Thomson thinks this is much under the mark; for he saw the complete leg of a Moa put together, in which the head of the thigh bone was six feet from the ground. As the Ostrich is seven feet high, and as the head of its thigh-bone is about half the height of the bird, Dr. Thomson, knowing that the legs of the Ostrich are reckoned to be proportionally longer for its height than those of the Moa, concludes that the Moa, whose inferior extremity he saw put together, must have stood, when alive, about thirteen or fourteen feet high. The Moa was unable to fly;

it had three toes on each foot, and some New Zealanders describe the domestic Cock as being a perfect picture in miniature of the largest Moa. Its feathers being described as most beautiful lead us to infer that they were of various colours, for Maoris are fond of gaudy hues. The bones of the leg of the Moa were filled with marrow, and not with air, like other birds: portions of the eggs of the bird have been found among the bones, of sufficient size to warrant the conclusion that a man's hat would have been a proper-sized egg-cup for a Moa's egg.

There are a few New Zealanders, says Dr. Thomson, who believe that some of these feathered giants still tread upon the earth; he heard from the natives several stories to this effect, but neither of them had the least appearance of fact: there are also Europeans in New Zealand who believe that Moas are still in existence in some of the remote and unfrequented wilds of the Middle Island. Mr. Colenso was told, in 1842, that a Moa was then living in the snow-capped hills above Cloudy Bay, and that two Americans, who resided in the neighbourhood, equipped themselves with fire-arms, and went in pursuit of the giant bird: they hid themselves in a thicket, and saw him stalking about in search of food, but they were so petrified with horror at the sight, that they were unable to fire. This Moa is described as 14 or 16 feet high; but Mr. Colenso discredited the story altogether. Several other stories are related of the existence of the Moa; and, were these true, Dr. Thomson considers there could be little doubt that a Moa of the largest breed may still be living in the solitudes of the Middle Island; and, if so, probably some enterprising colonist, from the settlements of Nelson, Otago, or Canterbury, might obtain a living Moa, and

realize fame and fortune by exhibiting it in the different capitals of Europe. However, Dr. Thomson does not credit the above stories: he has no doubt that the gigantic Moa is extinct; but he believes that a few more specimens of Mantell's Notornis may yet be found in the southern parts of Middle Island, which, however, has been thoroughly explored without the least trace of a living gigantic Moa having been seen. The Notornis caught alive in 1850 was two feet high.

Dr. Thomson thinks it probable that the Moa once lived on some of the tropical Polynesian Islands scattered about in the Pacific Ocean. The bones of the bird, it is true, have never been found in any of these islands, neither have the inhabitants any tradition about the animal; but they apply the term Moa to the domestic fowl. "Is not this a kind of proof," says Dr. Thomson, "that an animal resembling the New Zealand Moa lived at one time in these islands; otherwise, how is it to be accounted for that the same race of men should in one set of islands call a domestic fowl a Moa, and in another island confine the term Moa to the large struthious order of birds known to naturalists as the Dinornis? This is an important point in the history of the New Zealand Moa," which Dr. Thomson explains, first, by the similarity in language, customs, physical appearance, and character of the true Polynesian race which now people the numerous islands in the Pacific and New Zealand; they are all of Malay origin, and in Marsden's Dictionary of the Malay Language, the word *mua*, (sounded mooa,) is a species of pheasant; wherefore, it is obvious that before the Polynesians migrated from their original country, they were acquainted with a bird which they called the *Mūā*. On their arrival in

canoes at some of the Polynesian islands, they, probably, discovered the domestic fowl wild in the woods, and named it from its resemblance to the Mūā of their native country. In process of time, the wild bird became domestic, but still retained its original name. The Malays, who migrated to New Zealand, on the other hand, found there no domestic fowls indigenous to the country; but, they saw a new bird, as the ancient song says, to which they gave the term Moa, or Mua,—a name which the present generation say, was given to it on account of its moaning, *me mua* meaning, in Malayan, to make the voice peculiar to that bird. Yet the name may have been given to it from another cause. In course of time European vessels introduced the domestic fowl to the New Zealanders; the name Moa was already appropriated; so, they fell back on the word *Manuk*, the term for a bird or fowl from the Eastern islands. Manu, in the New Zealand language of the present day, is the general term for all birds, though it is likewise often applied to the domestic fowl, as a distinct name.

The next point is to ascertain the probable time at which the New Zealanders arrived in New Zealand. Certain stick-records, and the names of the chiefs of several tribes, written down from the mouth of well-informed persons among the names, are in the hands of Dr. Thomson, who considers that, taking the average of several tribes, there have been between eighteen and twenty-five generations of men since the arrival of the first settlers in New Zealand. The tribes appear all to have arrived in the country at the same time, although in different canoes; and, if we allow 22 years as the average reign of each of the Chiefs, this will indicate that the present race of natives arrived in New Zealand four or five hundred

years ago: in other words, they arrived about the fifteenth century.* At this time, Dr. Thomson thinks there could not have been many gigantic Moas in New Zealand: there must have been some, according to tradition; yet, several tribes who live in the northern part of the North Island, have no traditions about the Moa, and they have asked Europeans to describe to them what kind of animal it was. In the narrowest part of the island, no bones of the bird have been found; and, if the Moas had been so numerous as to have furnished food for the islanders, according to Professor Owen's idea, Dr. Thomson thinks we should have had a greater variety of traditions about them; in none of the accounts of what the natives saw when they first landed in New Zealand is there any mention made of their having seen a Moa on the sea-coast. The Dodo, according to Leguat, in 1708, was abundant near the coast.

The Dutch navigator, Tasman, (says Dr. Thomson,) visited New Zealand in 1642, but none of his crew landed, or had any colloquial intercourse with the natives, so that, from this visit, nothing about the Moas can be gleaned; and no other European navigator, who has written an account of his voyage, landed in New Zealand until after the Moas had become extinct. Captain Cook was told about a gigantic lizard which had lived in the country, but nothing of a gigantic bird.

With respect to the cause of the extinction of the gigantic birds, Dr. Thomson does not agree, with Professor Owen, that

* Dr. Thomson's reason for assuming twenty-two years as the average duration of the reign of each of the Chiefs is calculated in this way. In England, from William the Conqueror to William the Fourth, thirty-four sovereigns reigned for 763 years, which gives 22½ years as the average length of each reign, including those who died by violent deaths.

they were exterminated by the New Zealanders using them as food. The population never much exceeded 200,000 souls, a small population spread over a country nearly as large as England; and these people fearful of trespassing, and generally indolent. Here are mountain ranges, where the feet of men have rarely trodden. Dr. Thomson has walked through forests for thirty miles, without seeing the sign of a habitation: in such places, the Moa could find ample shelter at the present day. The Middle Island offers a still stronger argument: on it, the Maori population were scattered along the coasts, and were few in number; yet, according to the best information, no large Moa has been seen on that Island for upwards of one hundred and sixty years. "It is only," adds Dr. Thomson, "necessary to call to mind the difficulty there was in extirpating wolves from England, to have a clear idea of the improbability of the New Zealand race having caused the extinction of the Moa. In a small island, a race of large birds might be easily extirpated, and we have some recent examples of this; but in New Zealand, I think, the New Zealanders arrived to see the last of the large Moas die."

Now, the bones of Moas having been found in caves of more recent appearance than those found by Mr. Walter Mantell, in the cooking-holes of the New Zealanders at Waingongoro, would lead us to infer that some of the Moas died in these caves after the advent of the New Zealanders. Dr. Thomson inquired of a native of the district, what brought all these Moa's bones into caves, when he replied that long ago, an eruption of Tongariro occurred, which set fire to the country, and that the Moas fled to the caves, and there perished. This tradition, although it may be an exaggeration of some local conflagration, is of some value, in showing

that there were other causes destructive to the Moas, besides human agency. At Rotomarama, near the "Cave of the Spirit," one of Dr. Thomson's fellow-travellers asked a well-read Christian native, what destroyed all the Moas, and in reply he was told it was the great flood. The similarity of the words Noah and Moa may have suggested this to his mind; but Dr. Thomson's friend asked if it was not stated in Scripture that Noah took a pair of every living creature with him into the Ark, before the Flood: the man looked puzzled, and said "*awa*"—an exclamation too expressive to be rendered into English, but meaning "I don't know."

Another argument that the Moas died out, and were not extirpated by man, is the circumstance of the animals being found only in New Zealand previous to their extinction; for rarity, according to Sir Charles Lyell, precedes the extinction of all plants and animals, certain races of which have a period of creation, increase, and decay. Dr. Thomson then asks whether we may not place the extinction of the gigantic Moa at about the seventeenth century, and this slightly hastened, but not produced by the hand of man; and that New Zealand was the last refuge for wingless birds.

The New Zealanders always describe the Moas as being very fat; and they, probably, were of an indolent nature, and not much given to moving about. They lived in mountain fastnesses and in secluded caves; or, if not in the latter, they resorted there to die. The Ostrich and the Emeu live in plains; perhaps, the habits of the Moas were somewhat similar to these birds, and they may only have retreated to hills, forests, and secluded places, after the approach of man. The Kiwi or Apteryx is found in such places; and this strange bird may have some of the habits of the Moa. Dr.

Thomson adds: "the Moas lived chiefly on vegetable food, as may be concluded from the adze-like shape of the beak, from their bodies being described as very fat, (no flesh-eating bird is ever fat,) from nature having endowed them with feet and toes remarkably well adapted for uprooting ferns and other subterrestrial substances which abound in New Zealand, and from their swallowing stones to assist in digestion: no flesh-eating animal ever does this." That the Moa was dull and stupid is inferred from the skull being low and flat, and is confirmed by the traditions of the New Zealanders. The bones being found in a tolerably perfect state is strong evidence of the recent existence of the birds.

The discovery of the gigantic Moa in the comparatively small tract of New Zealand has naturally led the geologist to suppose that there was once a large mass of land to provide for the sustenance of such huge creatures: hence, it has been inferred that the nucleus around which the Australian current runs is the central higher portion of what was a large continent, once united with New Zealand. But there is little resemblance between its flora and fauna and those of Australia, in the ossiferous caves or tertiary deposits of which Moa's bones are not found. Prof. Owen thinks New Zealand may have been once connected with America; and he is inclined to regard New Zealand as one end of a mighty wave of the unstable and shifting crust of the earth, of which the opposite end, after having been submerged, has again risen with its accumulated deposits in North America, showing in the Connecticut sandstones the footmarks of the gigantic birds which strode its surface before it sank; and he surmises that the intermediate body of the land-wave along which the Dinornis may have travelled to New Zealand has progressively subsided,

and now lies beneath the Pacific.* But, to give weight to this idea, it would be requisite to discover the bones of some of these birds. Whatever may be the explanation of the Moa being confined to the New Zealand group of islands, Dr. Thomson cannot bring himself to believe that the gigantic Moas were ever hatched to live and die on the small spot of earth we now call New Zealand.

The same reasoning which applies to New Zealand may be applied to the Island of Madagascar, where have been found eggs of birds which contain the substance of 240 hen's eggs. This isle may be the remnant of a former vast eastern continent, now submerged; and Professor Edward Forbes adduces proofs of the existence of such ancient continents, derived from the present insulation of certain groups of plants and animals.†

The wingless birds which still live in the world,—though in solitary places, far away from the haunts of men—appear to be a condemned race: wherever men are, these birds disappear, even without the use of destroying agencies. The Ostrich dwells under a burning sun, and on sandy deserts, where men can scarcely live. The American Rhea vegetates in safely secluded places, for it can perceive the approach of men, when it cannot be observed by the eyes of men. The Emeu is fast disappearing before the colonization of Australia. The Apteryx lives in secluded places; and the Cassowary is very rare in the few islands where it is known to be indigenous.

Dr. Thomson suggests that these strange wingless birds may have been created at a period long prior to that of the higher

* Memoirs on the Dinornis. Part II.

† Memoirs of the Geological Survey.

order of quadrupeds; for we see the marks of their feet in sandstones of an early date. New Zealand appears, according to the testimony of the natives, in former days, to have abounded in Saurian reptiles of immense size. There were no land mammalia on the islands; but many birds, ferns, and fern-like plants. Some, growing to the height of sixty feet, are found covering a great part of the North Island; the largest and most abundant timber-trees, are here in great number; all tenants of the wonderful country in whose history "the big bird" is wrapped in unfathomable mystery. —It has been well said that "one of the most mysterious phenomena in natural history is the extinction of species—it is second only to the mystery of their successive appearance in geological time."

Meanwhile, Mr. Mantell's extensive collection of the remains of great wingless birds from New Zealand have been deposited in the British Museum; and there has been constructed with the actual bones of one and the same individual bird, the skeleton of the Elephant-footed Dinornis; a worthy companion of the Megatherium and Mastodon in the gallery of fossil remains in our national Museum.

Among the more recent searches for the bones we should mention that Major J. Michael of the Madras Staff Corps, who was some time in New Zealand, obtained a most remarkable specimen, which he has placed in the Madras Government Museum. This consists of the leg-bones, namely, the femur, tibia, metatarsus, and outer toe,—total length, 7 feet 3 inches. These bones were found at Glenmark, about 40 miles north of Christchurch, in the Canterbury province of New Zealand. Major Michael, when at Otago, was shown by Dr. Hector, the eminent explorer, some Moa bones of far inferior size;

he has reluctantly come to the conclusion that the bird is extinct in New Zealand; but that it has only recently died out is clear from the freshness of the remains which are found: in one instance a head was found with the lower mandible adhering to the upper. Sir John Herschel observes that should the Dinornis be, (as is hardly possible,) not yet entirely extinct in the unknown interior of the Australian continent, it must take the precedence of the Ostrich as *giant of living birds*, its skeleton standing 11 feet in height.

The statement that a Moa has been seen alive in New Zealand, and that a colonist had offered a reward of 500*l.* for its capture, dead or alive, has fostered belief in the story. M. Berthold Seeman, the well-known naturalist, considers that if extinct, the Moas have become so, probably, in quite recent times—that is to say, since the occupation of New Zealand by the Maories. This opinion Mr. Seeman maintains, in his official Reports on the Fiji Islands, presented to Parliament, in 1862, where he says: "Toa is the Fijian form of the word *Moa*, applied throughout Polynesia to domestic fowls, and by the Maories to the most gigantic extinct birds (*Dinornis*) disentombed in New Zealand. The Polynesian term for birds that fly about freely in the air is Manu or Manumanu; and the fact that the New Zealanders did not choose one of these, but the one implying domesticity and want of free locomotion in the air, wou'd seem a proof that the New Zealand Moas were actually seen alive by the Maories about their premises, as stated in their traditions, and have only become extinct in comparatively recent times."

We specially recommend to the reader Dr. Thomson's very able paper in the *Edinburgh Philosophical Journal*, No. 112, April, 1854.

XIV.

THE LAST OF THE DODOS.

THE habits of this strange bird are only vaguely alluded to by a few old travellers, and its form is known to us but by half-a-dozen rude figures; the only remains of it are part of a skull in the Museum of Copenhagen; a head and foot in the Ashmolean collection, (now removed to the New Museum at Oxford;) and another foot in the British Museum. These fragmentary evidences are, however, of great interest. There is no reason to believe that this bird exists at the present day; for it is one of a few species of animals that seem to have become extinct within the historical period—that is, a period of which we have trustworthy record.

"With such events (says an acute critic) the geologist is perfectly familiar in the pre-adamite history of the strata of the earth; and one of the most certain indications that he possesses of the age of particular rocks is the remains of animals that have become extinct within the period of the deposit of these rocks. It is a fact lying at the foundation of the application of palæontology to geology, that species, like individuals, have a limited period for their existence. The inquiries of the palæontologist show that this is not only the case with species but with groups of species—genera and families. Although the fact of the extinction of species

is well known, the causes leading to this phenomenon are not so evident. In many instances it appears that new or higher creations have produced the circumstances under which previous ones have ceased to exist. Whether, however, the extinction of pre-adamite species is to be attributed to the creation of new forms, or to a change in the physical condition of the globe, the knowledge which we at present possess of the causes of extinction of animals within the historical period traces them mainly to the existence of man. Many instances are on record of various species of animals being entirely extirpated in particular districts by man. We need but allude to the fact that many animals formerly inhabiting our own islands are either entirely destroyed or are rapidly diminishing in numbers. Some of these still survive in other parts of the world—but some have entirely disappeared. Thus, the Irish Elk, and the Urus, have both apparently lived in this country since the creation of man—but both are now become extinct. The circumstance of the extinction of these animals is interesting, as confirming the fact that the pre-adamite species have been lost not by gradual transitions into other forms, but by the destruction of every individual bearing well-known specific characters." *

This inquiry is of so much interest as to have led to the publication, in 1849, of a splendid work, entitled *The Dodo and its Kindred*, by H. E. Strickland, M.A., and A. G. Melville, M.D., wherein are assembled credentials which are by no means inconclusive as to the existence and nature of this singular bird. Nor does the Dodo stand alone; for, just as the history of the pre-adamite species exhibits to us the destruction of several species at about the same time from

* Athenæum, No. 1111.

the same causes,—so it appears that the Dodo was but one of a group of birds that inhabited those three little islands of the Indian Ocean known by the name of Mauritius, Rodriguez, and Bourbon. The destruction and extinction of these Dodo-like birds is of interest in relation to the extinction, (perhaps even this may have occurred since the creation of man,) of the group of gigantic Birds in New Zealand, of which the Dinornis is the type—as noticed in the preceding paper.

Although the island of Mauritius was discovered at the very commencement of the sixteenth century, it does not appear that anything definite was recorded of its productions till the year 1598, when the Dutch took possession of the island, and found on it a variety of pigeons, parroquets, and other birds: among these were some the size of swans, with a large head, furnished with a kind of hood; no wings, but in place of them three or four small black quills; and the tail consisted of four or five curled plumes of a grey colour. The Dutch sailors called them *Walckvögels*, or *disgusting birds*, from the toughness of their flesh, as might be expected from their strongly developed muscles.

In a subsequent account of the islands, given by a Dutch sailor, who visited it in 1602, there are several references to the Dodo: thus, he tells us—"The sailors were out every day to hunt for birds and other game, such as they could find on the land, while they became less active with their nets, hooks, and other fishing-tackle. No quadrupeds occur there except cats, though our countrymen have subsequently introduced goats and swine. The herons were less tame than the other birds, and were difficult to procure, owing to their flying among the thick branches of the trees. They also caught birds which some name *Dod-aarsen*, others *Dronten*;

when Jacob van Neck was here, (in 1598,) these birds were called *Walckvögels*, because even a long boiling would scarcely make them tender, but they remained tough and hard, with the exception of the breast and belly, which were very good; and also, because, from the abundance of turtle-doves which the men procured, they became disgusted with the Dodos. These birds have great heads, with hoods thereon; they are without wings or tail, and have only little winglets on the sides, and four or five feathers behind, more elevated than the rest. They have beaks and feet, and commonly in the stomach a stone the size of a fist. . . The Dodos, with their round sterns, (for they were well fattened,) were also obliged to turn tail; everything that could move was in a bustle; the fish which had lived in peace for many a year, were pursued into the deepest water-pools. . . . On the 25th of July, Willem and his sailors brought some Dodos, which were very fat; the whole crew made an ample meal from three or four of them, and a portion remained over. . . . They sent on board smoked fish, salt dodos, land-tortoises, and other game, which supply was very acceptable. They were busy for some days bringing provisions to the ship. On the 4th of August Willem's men brought fifty large birds on board the *Bruyn-Vis*; among them were twenty-four or twenty-five dodos, so large and heavy, that they could not eat any two of them for dinner, and one that remained over was salted."

Subsequent navigators and travellers described the Dodos —and many of them gave drawings of the birds—quaint, odd-looking, as if made by children learning to draw. There are also several well-finished portraits of the bird extant. One of these, and that from which all the pictures in natural

history books are taken, is now in the Zoological Gallery of the British Museum. This picture was brought from Holland, and was originally the property of Sir Hans Sloane, but it has neither date nor artist's name. Mr. Strickland supposes that it was painted by one of the Saverys from the living bird. In the Royal Collection at the Hague there is a painting by Roland Savery representing Orpheus charming the animal creation, in which Professor Owen was the first to discover the portrait of a Dodo. Another portrait by Savery exists at Berlin, and one at Vienna.

The British Museum picture is well engraved in the *Penny Cyclopædia*, art. Dodo. In the Museum also is preserved a Foot of a Dodo, the measurement of which corresponds with a specimen figured by Clusius, in 1605, from a rough sketch in the journal of a Dutch voyager who had seen the bird in a voyage to the Moluccas in the year 1598. The Leg in the British Museum is that which was formerly among the "rarities" of the Royal Society, who gave it to the national establishment.

It has been stated that the Museum painting came into the possession of Sir Hans Sloane, and that it was bought at his sale by Edwards, who, after publishing a plate from it in his *Gleanings*, presented it to the Royal Society, whence it passed, as well as the Foot, into the British Museum. But Mr. Gray maintains that the *Foot only* came from the Royal Society's Museum; and that the picture was an especial gift from Edwards. Edwards's copy seems to have been made in 1760, and he himself says: "The original picture was drawn in Holland from the living bird brought from St. Maurice's Island, in the East Indies, in the early times of the discoveries of the Indies, by the way of the Cape of Good Hope. It

was the property of the late Sir Hans Sloane to the time of his death; and afterwards becoming my property, I deposited it in the British Museum, as a great curiosity. The above history of the picture I had from Sir Hans Sloane and the late Dr. Mortimer, Secretary to the Royal Society."

We now come to the Portrait, by John Savery, in the Ashmolean Collection, which picture was presented to the University of Oxford with the rest of Tradescant's curiosities, originally the nucleus of the Ashmolean Museum. This Mr. Strickland conjectures, may have been the "picture of a strange fowl" alluded to in the following note by Sir Hamon Lestrange, which now exists in MS., in a copy of Sir Thomas Browne's *Vulgar Errors* in the British Museum:

"About 1639, as I walked London streets, I saw the picture of a strange fowle hong out upon a cloth [hiatus in the MS.], and myselfe with one or two more in company went in to see it. It was kept in a chamber, and was a great fowle somewhat bigger than the largest turkey cock, and so legged and footed, but stouter and thicker, and of a more erected shape, coloured before like the breast of a young cock fesan, and on the back of dunn or deare colour. The keeper called it a Dodo, and in the end of a chymney there lay a heap of large pebble stones, whereof hee gave it many in our sight, some as big as nutmegs, and the keeper told us shee eats them (conducing to digestion), and though I remember not how farr the keeper was questioned therein, yet I am confident that afterwards she cast them all againe."

Thus far the Ashmolean Picture. There was likewise in the collection an *entire* Dodo, of which the head and foot remain at Oxford. As Tradescant was living at the time when the Dodo was exhibited in London, it is not improbable

that he secured the bird entire. For though only the head and foot remain, the evidence is plain that when Ashmole presented the University of Oxford with Tradescant's Museum, there was *a whole Dodo.* Particular mention is made of it as existing in 1700; what then became of it?—Mr. Strickland shall answer:

"The stuffed specimen of the Dodo mentioned in the Catalogue of Tradescant's Museum, 1656, was bequeathed with the rest of his curiosities to Elias Ashmole, the munificent founder of the Ashmolean Museum at Oxford. Here it remained in an entire, if not a very perfect state, till 1755, when the Vice-Chancellor, and the other Trustees, to whose guardianship the worthy Ashmole had confided his treasures, came in an unlucky hour to make their annual visitation of the Museum. In those days, Oxford presented the still existing anomaly of a University, in which Zoology was not publicly taught as a science; the Royal Society had long removed to the metropolis, the Ashmolean Society was as yet unborn, and the Taylor Institution had not opened a door to continental literature. The literary and scientific ardour which Lister, Plott, Aubrey, Ashmole, Wood, Llhwyd, and others had awakened in the seventeenth century had now subsided, and the University seems to have relapsed into the scholastic torpor of the middle ages. We do not therefore wonder at the fate which befell the LAST OF THE DODOS. This unhappy specimen, then at least a century old, had, it appears, become decayed by time and neglect; and according to a record now extant, with many others, 'ordered to be removed at a meeting of a majority of the visitors.' On this fatal decree, Mr. Lyell appropriately remarks:—'Some have complained that inscriptions on tombstones convey no general

information, except that individuals were born and died—accidents which happened alike to all men. But the death of a *species* is so remarkable an event in natural history that it deserves commemoration; and it is with no small interest that we learn from the archives of the University of Oxford the exact day and year when the remains of the last specimen of the Dodo, which had been permitted to rot in the Ashmolean Museum were cast away. The relics we are told were 'a Museo subducta, annuentibus Vice-cancellario aliisque Curatoribus, ad ea lustranda convocatis, die Januarii 8vo, A.D. 1755.'" The Dodo, is one of those which are here without the number.

By a lucky accident, the head and one of the feet were rescued from the flames; and thus were saved these remains, which have furnished the subject of almost the only contribution to natural history science made by Oxford during the century.

The Duke of Northumberland also possesses, at Syon House, an original Painting, including a large figure of the Dodo, with the monogram of the signatures of Jean Goeimare and Jean David de Heem, 1627.

A question of much interest has arisen amongst zoologists as to what section of birds this great, wingless, creature belonged. Mr. Vigors thought it was a gallinaceous bird allied to the ostriches; and Cuvier was of this opinion, from the fossil head, sternum, and humerus of a Dodo discovered in the Isle of France, in 1830. M. de Blainville referred it to the order comprising the vultures and eagles—a view in which Mr. Gould agreed. Mr. John Edward Gray thought the head and foot at Oxford belonged to different birds; the head to a vulture, the foot to a gigantic barn-door fowl.

Professor Owen, after a lengthened examination, adjudged it to be a vulture or a raptorial bird. But to none of these families does it really belong. Professor Reinhardt first suggested that it might be a large form of the Columbidæ,—the Pigeon family, urging :—

"There is no *à priori* reason why a Pigeon should not be so modified, in conformity with external circumstances, as to be incapable of flight, just as we see a Grallatorial bird modified into an Ostrich, and a Diver into a Penguin. Now we are told that Mauritius, an island forty miles in length and about one hundred miles from the nearest land, was, when discovered, clothed with dense forests of palms and various other trees. A bird adapted to feed on the fruits produced by these forests would, in that equable climate, have no occasion to migrate to distant lands; it would revel in the perpetual luxuriance of tropical vegetation, and would have but little need of locomotion. Why then should it have the means of flying? Such a bird might wander from tree to tree, tearing with its powerful beak the fruits which strewed the ground, and digesting their stony kernels with its powerful gizzard, enjoying tranquillity and abundance, until the arrival of man destroyed the balance of animal life, and put a term to its existence. Such, in my opinion, was the Dodo, a colossal, brevipennate, frugivorous Pigeon."

Mr. Strickland and Dr. Melville also show that three other species of birds inhabited the islands of Bourbon and Rodriguez, and were sometimes described as Dodos. One of these, found in Rodriguez, has been called the Solitaire; and of this remains exist in the museums of Europe. There is sufficient evidence of the structure of them all to lead to the conclusion that they were birds closely allied to the Dodo,—

and that they became extinct at about the same time and under the same circumstances as that bird.

The bones of a large kind of bird, which no longer exists in Rodriguez, have been dug up in a cavern in the island. It is stated that the Dutch who first landed at Rodriguez, left cats there to destroy the rats which annoyed them: these cats have since become very numerous, and prove highly destructive to poultry; and it has been suggested that they may have destroyed the large kind of bird to which the bones belonged, by devouring the young ones as soon as they were hatched,—a destruction which may have been employed long before the island was inhabited. Still, the cause of the entire disappearance of the species from the island, where it seems to have been once abundant, can only be conjectured.

Of the Picture in Holland, Professor Owen relates: "While at the Hague in the summer of 1838, I was much struck with the minuteness and accuracy with which the exotic species of animals had been painted by Savery and Breughel in such subjects as Paradise, Orpheus charming the Beasts, &c., in which scope was allowed for grouping together a great variety of animals. Understanding that the celebrated menagerie of Prince Maurice had afforded the living models to these artists, I sat down one day before Savery's Orpheus and the Beasts, to make a list of the species which the picture sufficiently evinced that the artist had had the opportunity to study alive. Judge of my surprise and pleasure in detecting in a dark corner of the picture, (which is badly hung between two windows) the Dodo, beautifully finished, showing for example, though but three inches long, the auricular circle of feathers, the scutation of the tarsi, and the loose structure of the caudal plumes. In

the number and proportion of the toes, and in general form, it accords with Edwards's oil painting in the British Museum; and I conclude that the miniature must have been copied from the study of a living bird, which it is most probable formed part of the Mauritian menagerie. The bird is standing in profile, with a lizard at its feet. Not any of the Dutch naturalists to whom I applied for information respecting the picture, the artist, and his subjects, seemed to be aware of the existence of this evidence of the Dodo in the Hague collection."

We have a few words more to say upon the affinity of the Dodo to the pigeons. Dr. Melville has minutely examined the head and foot of the Dodo, which favour the above view, showing it to be related neither to the gallinaceous birds, the ostriches, or the vultures, as others have conjectured; but to be closely allied to the pigeons. Dr. Melville maintains that the sternum of the Dodo more nearly resembled those of the pigeons than of any other family; that the skin proves it to be a pigeon; and that it fed upon cocoa-nuts, mangoes, and other fruits which, in tropical forests, fall from the trees at all seasons of the year.

The living Bird which approximates nearly to the Dodo, is the Tooth-billed Pigeon, which is found in the Samoan Islands in the Pacific Ocean. Though smaller in size than the Dodo, it combines the character of a rapacious bird with that of the harmless pigeon. Although its mandibles are powerful in structure, yet the beak is never used as an offensive weapon; for Dr. Bennett tells us that when the hand is placed in the cage, or the bird is seized for removal from one cage to another, it never attempts to bite the aggressor, but, on the contrary, is so timid that, after fluttering

about, or running into a dark corner of the cage, in its efforts to escape, it soon becomes subdued, and is easily taken. In all the families of pigeons a diversity in the form of the beak is found. In the fruit-eating pigeon the beak is stronger, stouter, and the horny portion is strongly arched and compressed, bearing a great resemblance to the structure in certain rapacious birds. Now, this form of beak is carried to the greatest extent in the Tooth-billed Pigeon (*Didunculus*), yet the living birds in captivity were never observed to crush almonds, and hempseed, with the same action as is observed in the parrot-tribe when feeding. When Dr. Bennett first had the birds, boiled potatoes and stale bread formed their diet. The boiled potatoes were torn and swallowed in large pieces at a time, being soft; but the stale bread the birds would place their feet upon and tear with the hooked beak into small bits.

The bird has nothing particular in its plumage to attract the attention of the common observer; but the head of a rapacious bird on the body of a pigeon would excite the attention of the most ordinary spectator. The plumage of this bird is of a chocolate-red colour, deeper on the back, tail, and the primaries and secondaries of the wings, and barred over the breast, throat, and wing coverts with light brown. The upper part of the head is rather bare of feathers, but those remaining are of a dark slate colour. The base of the beak is of an orange-red, and the rest of the mandibles yellowish. The legs and feet are of a bright orange-red. The cere round the eyes is of a flesh colour. The irides are of a dark reddish brown. The form of the beak and the bright eyes impart to the bird very much the character of a rapacious bird. The above is the state of the plumage in the young bird.

LOST ANIMALS.

Supplementary to our accounts of two extinct animals, of very remarkable character, it may be interesting to glance at the circumstances which attest the disappearance of certain Lost Species, with a few additional references to the instances we have just described.

The eminent naturalist, M. Marcel de Serres, observes that if we adopt the interpretation admitted by a number of Bible commentators, the Lost Species of Animals would be those which were destroyed by the Deluge, as mentioned in 21st, 22nd, and 23rd verses of the 8th chapter of the Book of Genesis.

There is no need of very extraordinary means to produce the destruction of a great number of living species; and there are many belonging to the existing creations, and of which we now find no traces on the earth, although certain of them were seen in times not very distant from our own. Such is the case with the Dodo, which, as we have just described, was seen in 1616, in the Island of Mauritius, and subsequently in England. We no longer there find this bird; and since that time it has not been observed elsewhere. The race is now, therefore, extinct.

Such also appears to be the case with the gigantic Horned Stag. Yet this animal was represented in the pictures of ancient Rome; and according to the writers of antiquity, it was sent from England on account of the delicacy and excellence of its flesh. The same animal was known to Oppian, the classic poet of old Rome. Aldrovand, the celebrated Italian naturalist, of the sixteenth century, and

Munster, both appear to have seen this gigantic horned stag alive; Munster even pretends that he ate of it, which would prove that the species was not extinct in 1550. The bone of a gigantic stag found by Mr. Hart, in the vale of Arno in Italy, confirms the report of these writers; or, at least, demonstrates that the destruction of this animal took place prior to historical times.

The Dinornes are likewise birds of which we know no representation now living. They belong, however, to our epoch, for their nests have been discovered on the coasts of New Holland; these nests are as remarkable for their dimensions as are the birds which construct them. They evidently belong to the existing period M. de Serres considers, for the natives of New Zealand have preserved the recollection of them, and name them *Moa*.

It is even possible that the ancients may have represented the Dinornes on their monuments, and that these birds are no other than the gigantic cranes mentioned in the legends of Eastern nations. Mr. Bonomi saw, upon the tomb of an officer of Pharaoh belonging to the fourth dynasty, a bas-relief, in which birds of this kind were represented of very large dimensions.

No doubt, the disappearance of those species which lived not long since may appear at first sight very extraordinary; but it is easily explained when we attend to the organization of these animals. The Dodo, for example, which was formed neither for running nor flight, could not easily escape pursuit. The size of the Gigantic Stag prevented it, in like manner, evading the attacks made upon it. The establishment of Europeans in the island of Mauritius has thus been the principal cause of the disappearance of the Dodo, just as the

clearing away of the forests which covered the face of ancient Germany has occasioned the loss of one of the most remarkable animals of our world.

Many of the animals figured or sculptured on the monuments of antiquity, and uniting conditions which render their existence possible, have no longer representatives, as is also the case with certain species buried in the ancient catacombs of Egypt. Geoffroy Saint-Hilaire sought in vain in that country for traces of the two Crocodiles which he found embalmed in the Egyptian tombs.

There is no need, therefore, of extraordinary causes in order to destroy certain species: it is sufficient to bring about this result, that the animals cannot escape our pursuit, nor defend themselves against our attacks. It is obvious that they become extinct so much the more speedily, if their fecundity be inconsiderable, and the number of deaths exceeds that of the births. The loss of a species may, therefore, depend on the simplest circumstances, and be the effect of causes by no means beyond the ordinary course of things.

Here is an instance of gradual disappearance within the present century. The Great Bustard, the largest of European land birds, has almost disappeared in England; indeed, Mr. Gould, the distinguished ornithologist, considers that from the progress made in the science of agriculture, and various other causes, the Bustard may now be regarded as extinct in this island. Bustards, some thirty years since, were bred in the open parts of Suffolk and Norfolk, and were domesticated at Norwich. Their flesh was delicious, and it was thought that good feeding and domestication might stimulate them to lay more eggs; but this was not the case. There were formerly great flocks of Bustards in

England, upon the wastes and in woods, where they were hunted with greyhounds, and were easily taken.

The last abodes of the Great Bustard in England were Salisbury Plain, the Yorkshire Wolds, and the open country about Newmarket. In all these localities, it is now, however, extinct; its large size and wandering habits having rendered abortive all the efforts of the landowners for its protection.

The instances of Bustards taken in England have been very rare for half a century. In 1819, a large male bird was taken on Newmarket Heath; it was sold in Leadenhall Market for five guineas. A Bustard was shot in the Bustard-country (Norfolk) in 1830. Mr. Jesse knew a gentleman, a great sportsman, who assured him that he once had a *pack* of Bustards rise before his gun; he suddenly came upon them in a gravel-pit. Mr. Southey and Sir Richard Colt Hoare both mention the curious fact, that the Bustard has been known to attack men on horseback at night. A female bird was shot in Cornwall, in 1843. In the spring of 1844, a solitary female Bustard was killed near Bonython, in Cornwall, in a turnip-field, which it had frequented for some days previously; the country-people believed it to be an eagle, in consequence of its great size, and the noise with which it rose from its covert. In 1850, a female bird was shot on Romney Marsh; and another in Devonshire in 1851. A fine Bustard was shot on the estate of Baron Parke, at Less Hill, Kingswater, in 1854. In 1856, a very fine male Bustard was taken near Hungerford, in Berkshire, on the borders of Wiltshire, this being the only male taken for many years in England: it weighed 13½ lbs., and its wings measured from tip to tip 6 feet 3 inches; it is preserved in

the museum of the Zoological Society. A writer in the *Penny Cyclopædia (voce* Bustard) says: "We are old enough to remember one, and sometimes two, Bustards as the crowning ornaments of the magnificent Christmas larder at the Bush Inn, Bristol, in the reign of John Weeks, of hospitable memory; and we have heard, too, a romantic story of the last of the Salisbury Plain Bustards (a female) coming into a farmer's barton, as if giving herself up." We remember to have seen the Bustard in the Guildhall dinner bill of fare on Lord Mayor's Day, but do not remember the year of its disappearance: still these may have been foreign Bustards.

In the menagerie of the Zoological Society may be seen foreign specimens of the Great Bustard. Two were, in 1847, obtained from Central Germany, where Bustards are still found in considerable numbers. The British officers in the Crimea, in December, 1855, enjoyed much sport with flocks of Bustards, some of which were killed, weighing fifteen or sixteen pounds each. The plains of Spain, Italy, and the Levant, are also reported to produce a certain number of this species, which, though rapidly decreasing, has a very extensive geographical distribution. In India, Australia, and Africa, the Great Bustard is represented by kindred forms—of which, however, none exceeds it in beauty of colour or majesty of carriage. The adult males are adorned with a fan-like tuft of long slender feathers, which grow downwards and backwards from the chin, and not unfrequently attain a length of forty-five inches. In India, the Bustards are, however, very fine, they are pursued on horseback, and shot by pistols.

XV.

ANIMALS OF THE NINEVEH SCULPTURES.

THESE sculptured antiquities which are exhibited in the galleries of the British Museum are so many pages in stone illustrative of the history of Assyria and Babylonia, not of one age or period of time, but of successive epochs. Three thousand years have rolled away since the sculptor's hand plied "the chisel's art" upon their surface. They open to our contemplation the events of a succession of dynasties; they record the sieges of towns, the combats of warriors, the triumphs of kings, the processions of victors, the chains and fetters of the vanquished. But, in addition to these subjects of high interest to the student of ancient history, to the Zoological observer they present many drawings *ad naturam*, executed by artists of great eminence in their day and generation. Let us turn from kings and sâtraps, the conquerors and the conquered, to these not less interesting subjects. How numerous are the tableaux of lions and lion-hunts, how spirited and truthful are these chiselled lithoglyphs! Lions are before us in every attitude. Here we behold them in combat, as well as in moveable dens and cages, and the ferocity of the chase. One hunt presents us with four lions and two lionesses, dead or dying, transfixed with numerous arrows, or javelins in the arena. Wonderful is the picture! The attitudes of the animals are extremely

varied : in some the relaxed limbs show that death has ended their torments ; in others the agony is displayed in the contortions of the face and limbs, while blood starts from the wounds made by the weapons which often completely transfix the body. Painful to behold are the pictures of Lions struck through the muscles and spinal column of the back ; the lower limbs deprived of power, are dragging along the ground, while the head and shoulders are erect, and every lineament of the countenance exhibits the intensity of despairing rage. One of the accompanying engravings (1,) represents a wounded Lioness, whose hinder limbs are paralyzed by arrows through the backbone. This slab was discovered by Mr. H. Rassam.

In some instances we find represented a single combat—as a warrior grasping the tail of a Lion, which appears to be turning round on the defensive. On another slab we see a king grasping a rampant Lion by the throat, and passing his sword through the animal's chest ; while on another slab the king receives the Lion on his spear, which he is driving down his throat. Lions were also hunted on the open plains, roused by men and dogs from their lair ; of these dogs we shall speak presently.

The existence of a claw in the tuft at the end of the Lion's tail was disputed for ages ; but, in one of the sculptures of a Lion-hunt, in the Museum, is an exaggerated representation of the claw in support of this curious fact in natural history. The peculiarity was first noticed by Dydimus of Alexandria, an early commentator on the Iliad, who wrote forty years before the Christian era. Homer and other poets feign that the Lion lashes his sides, and Lucan states that he does so to stimulate himself to rage ; but neither of these writers adverts to the claw in the tail, although Dydimus, who lived one

hundred years before the last-named author, discovered the claw, and conjectured that its purpose was to effect more rapidly what Lucan ascribes to the tail alone. Whatever may have been the use or intention of this claw, its existence has been placed beyond dispute by Mr. Bennett, Secretary of the Zoological Society, who, in 1832 exhibited a specimen of the claw taken from a living lion in the menagerie in the Regent's Park. It is no small gratification to be able to quote in evidence of the statement of Mr. Bennett and his predecessor, Dydimus of Alexandria, the original and authentic document, on the authority of the veritable descendants of the renowned hunter, Nimrod; which any one may read who will examine the sculptured slab in the first room of the Assyrian collection in the British Museum.

The hunting-dogs, (3,) already alluded to, are finely portrayed upon another slab; they are of huge size, and most ferocious aspect, with rather short but pendulous ears, a large head, deep muzzle, and vigorous limbs. They much resemble the largest and fiercest of our old mastiffs. They were led by attendants, and secured by means of a leash attached to a strong collar, and were thus ready to be slipped. Their eagerness to rush forward is very finely characterized. No boar-hunt by Snyders, or stag-hunt by Landseer, is more truthful and spirited than are some of these Assyrian sculptures.

No sculptured dogs of antiquity that we have seen can for a moment be compared with these Assyrian mastiff hounds. Such were, perhaps, the dogs of which Herodotus speaks; who says that during the Persian occupation of Babylon, the number of these animals kept in the province was so great, that four cities were exempted from taxes for

maintaining them; they were "the dogs of war," the designation rendered familiar by our great Dramatic Bard's line:

Cry *Havock*, and let slip *the dogs of war*.

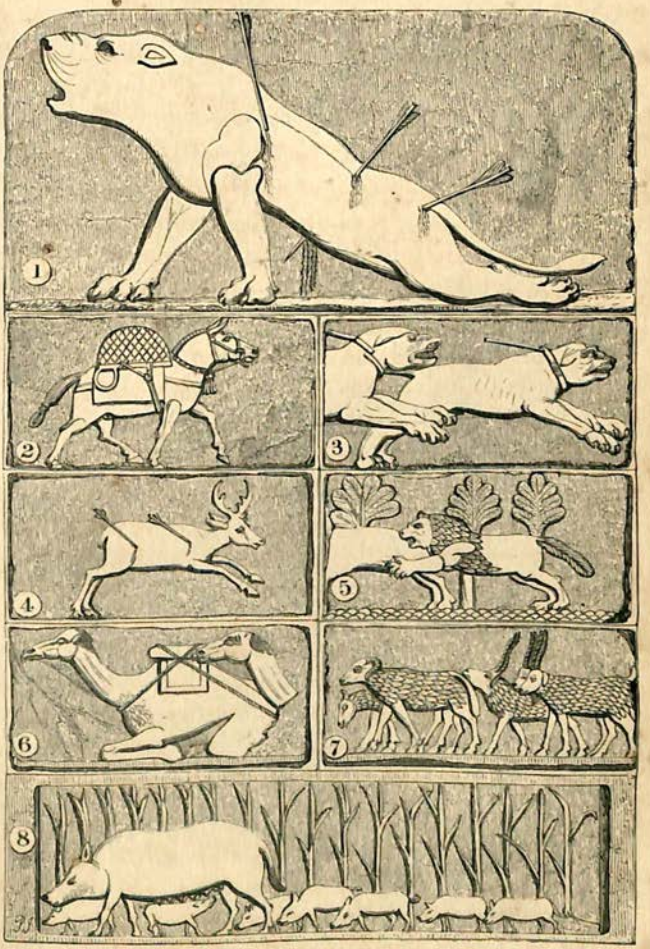
The Wild Ass, still to be seen west of Mosul, and on the banks of the Euphrates, is represented on many slabs—in a group scouring the Desert, and in an individual caught round the neck by a double lasso—the attitude of the animal is excellent. The Wild Bull, scarcely less formidable than the Lion, is also sculptured in contest with the king, accompanied by armed men, on horseback, in chariots, and on foot; together with a magnificent wild bull-hunt, and a bull prostrate and transfixed with javelins.

The Mule (2,) is finely portrayed: it was evidently used as a beast of burthen, and was a powerful animal, as shown in its fine form and proportions in the sculpture; it is represented going to the hunting-ground, carrying a portion of a net inclosure. This slab was discovered by Mr. Loftus.

The Stag (4,) is portrayed upon another slab, discovered by Mr. Loftus. It is transfixed with arrows.

The Cheetah, or Hunting Leopard, (5,) is depicted on the Nimroud obelisk, discovered by Mr. Layard: the Cheetah is attacking a stag or gazelle.

The Camel (6,) is from one of Mr. Boutcher's sketches, and is figured on the celebrated obelisk: it is the Bactrian or two-humped Camel, which is a native of the great steppes inhabited by the Tartar tribes, and is not known in Syria, Arabia, or Egypt, except as a foreign animal: the range of this Camel extends through Central Asia, Thibet, and the Chinese borders; it is the Camel of the Crimea, and the regions around the Black Sea. It occurs in a triumphal



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NINEVEH ANIMALS.

1. Wounded Lion.
2. Mule.
3. Hunting Dogs.
4. Wounded Stag.
5. Hunting Leopard
6. Camels.
7. Sheep and Goats.
8. Sow and Litter of Pigs.

procession. The two breeds, the ordinary Camel of burden, and the light swift breed, or Dromedary, are distinctly characterized on one slab taken from the central ruins at Nimroud. Bonaparte, when in Egypt, had a dromedary corps, each animal carrying two soldiers.

The Sheep and Goats (7,) are represented on many slabs. The Sheep are occasionally of the fat-tailed race: others resemble the British breeds, especially the Dorset. The Goats have horns, straight, with a spiral twist. These are from slabs found by Mr. Layard.

The Sow and litter of Pigs (8,) are from the Kouyunjik Gallery, in the Museum.

The noble breeds of Horses among the Assyrians are finely represented. Among the smaller quadrupeds is the Hare, which is less than our common European species.

The slabs of Birds are very interesting. The Ostrich is represented incised on the robe of an eunuch; and always in connexion with scenes of battle and slaughter is the vulture conspicuous: "For wheresoever the carcase is, there will the eagles be gathered together." (Matt. xxiv. 28.) On one slab, the capitulation of a city, we behold three vultures, two on the wing, and one feasting on the body of a slain warrior. Besides the Vulture we have the Pigeon and the Swallow, and the Hawk. The birds are more conventionally drawn than the quadrupeds, and do not appear to have been so diligently studied by the artists, who, however, fail both in their figures of the elephant, and the apes or monkeys.

Turning from land-scenes to the representations of rivers, or the margin of the sea—on which are war-galleys, boats, and men swimming—we see fish in abundance: some short and scaled, others long and eel-like, together with crabs, and

tortoises, and other reptiles: to attempt to determine the species, would be useless—the artists having taken more pains with the water than the animals. The specimens engraved are but a small selection from these treasures of antique art, of which our national Museum possesses the finest assemblage in existence. From the *Illustrated London News*, wherein special attention has very properly been paid to these very interesting subjects, our engravings have been chosen, with a few of the accompanying descriptive details.

To wander through the galleries of the British Museum appropriated to these sculptures is an intellectual luxury. For realizing the full value of the objects around us, in due time, we begin to grow familiar with the Kings and their antecedents, with the people and their habits, with their wars and triumphs, their splendour and their barbarity. We are soon constrained to acknowledge that however elevated in the arts, or powerful as a nation, the Assyrians may have been, they were a cruel people,—cruel in their wars, cruel to the vanquished, cruel to the wild animals of the chase; they delighted in bloodshed; their conquests were followed by wholesale slaughter, and the chase, evidently a passion, was merely a battue.

XVI.

AUSTRALIAN ANIMALS.

SYDNEY SMITH wrote, many years since, with that exquisite humour, of which he possessed so rich a vein:—"In this remote part of the earth, (Australia,) Nature, (having made horses, oxen, ducks, geese, oaks, elms, and all regular and useful productions for the rest of the world,) seems determined to have a bit of play, and to amuse herself as she pleases. Accordingly, she makes cherries with the stone outside; and a monstrous animal, as tall as a grenadier, with the head of a rabbit, a tail as big as a bedpost, hopping along at the rate of five hops to a mile, with three or four young Kangaroos looking out of its false uterus, to see what is passing. Then comes a quadruped as big as a large cat, with the eyes, colour, and skin of a mole, and the bill and web-feet of a duck, puzzling Dr. Shaw, and rendering the latter half of his life miserable, from his utter inability to determine whether it was a bird or a beast. Add to this a parrot with the legs of a sea-gull; a skate with the head of a shark; and a bird of such monstrous dimensions, that a side-bone of it will dine three real carnivorous Englishmen;—together with many other productions that agitated Sir Joseph Banks, and filled him with emotions of distress and delight."

This is a ludicrous picture of some of the animated creatures of the singular continent of Australia, the land of

Marsupials, or Mammalia which carry their young in pouches, including the opossums, kangaroos, wombats, phalangers, &c. Of these only one genus, the Opossum, is found in America. All the other genera belong exclusively to Australia, Van Diemen's Land, and the islands of the Asiatic Archipelago, as far as Java. In Australia, they constitute an immense majority of the mammalian species, in which, with this exception, the Continent is exceedingly poor. In the islands of the Archipelago, only seven species are enumerated, among which is one Kangaroo, said to occur in Java. In no other part of the Old World are any marsupial animals belonging to this class found living; and if we would seek for indications of them, singularly enough it is in the fossil remains in the oolites of the south of England, the antipodes of the region which they now almost exclusively possess.*

The peculiar provision of the *pouches* has been thus explained. The distinguishing characteristic of Australia is its extreme dryness; and it has been supposed by physiologists that the object of this singular organization—the pouch—is to enable them to transport their young when they are obliged to traverse great distances, in order to obtain the means of quenching their thirst. If no such contrivance as the pouch of the Marsupials existed, the young would probably perish while the mother wandered about in search of water.

The Marsupials have been charged with "stupidity," of which this explanation has been offered. Professor Owen, in his new classification of the Mammalia, has very properly placed the Marsupials, (of which the Kangaroo is a good example,) among the order Lyencephala, so denominated from the fact that the two hemispheres of the brain are nearly

* Sir John Herschel: Physical Geography; Encyclopædia Britannica.

separate in all its members. The great commissure, or *corpus callosum*, as it is called by the anatomists, is entirely wanting. The Lyencephala are remarkable for deficiency of intelligence. The attendants at the Gardens of the Zoological Society, in the Regent's Park, observe that the Marsupials never know them; and that while a tiger or other noble carnivore learns in a few days that he cannot get out of his cage, a Marsupial carnivore, like "the Tasmanian Devil," seems never to realize the hopelessness of all attempts to escape.

Another character, described by Professor Owen, no less uniformly belonging to these animals, is the want of power in uttering vocalized sounds. When irritated, they emit a wheezing, snarling, guttural sound; that of the Ursine Opossum is the clearest and the nearest approach to a growl. Mr. Harris, however, states that in addition to this noise, the Ursine Opossum utters a kind of hollow barking. The large Dog-faced Opossum, he observes, "utters a short guttural cry, and appears exceedingly inactive and stupid, having, like the owl, an almost constant motion with the nictitating membrane of the eye." The Wombat, when irritated, emits a loud hiss, which forcibly reminds one of that of the serpent. The noise emitted by the Kangaroo under similar circumcumstances, is equally remote from a vocalized sound; the necessary apparatus for producing which, Cuvier long ago observed to be wanting in the larynx of this animal.

We shall now briefly describe the group of animals which our Artist has illustrated.

The Vulpine Opossum is not unlike the common Fox, but only 26 inches in length, of which the tail is 15 inches.

The Koala, native name said to signify "Biter," is as large as a moderately-sized dog, has the gait and carriage of a

young bear, and passes its life upon trees, and in dens or holes, which it hollows at their feet: its locality is New Holland.

The Squirrel Petaurus, in the broad expansion of the skin on each side of the body, extending between the fore and hind limbs, closely resembles the Flying Squirrel; and in common with nearly the whole of the mammiferous quadrupeds of the country which it inhabits, possesses the abdominal pouch which fixes its place among the Marsupials. During the day, the animal nestles in the hollows of trees, but becomes animated as night approaches, and skims through the air, supported by its lateral expansions, half leaping half flying from branch to branch, feeding upon leaves and insects. This mode of locomotion can scarcely be considered as a true flight; but it may be doubted whether the animal is entirely destitute of the power of exercising its will in these flight-like leaps. Mr. Broderip relates that on board a vessel sailing off the coast of New Holland, was a Squirrel Petaurus which was permitted to roam about the ship. On one occasion it reached the mast-head, and as the sailor who was dispatched to bring it down, approached, made a spring from aloft to avoid him. At this moment the ship gave a heavy lurch, which, if the original direction of the little creature's course had been continued, must have plunged it into the sea. All who witnessed the scene were in pain for its safety; but it suddenly appeared to check itself, and so to modify its career that it alighted safely on the deck. This species inhabits New South Wales, and is said to be abundant at the foot of the Blue Mountains. Its fur, grey, black, and white, would be highly ornamental, from its colour, softness, and beauty, as an article of dress.

The Kangaroo, discovered by Captain Cook,* is now well known. Our countryman pursued it in New Holland with greyhounds, and the leaps which it took enabled it to clear obstacles seven or eight feet high. In size it equals a sheep, some of the largest weighing 140 pounds; the flesh is a little like venison. The female produces but one at a time, which, when born, is scarcely half so large as a mouse; it is carried in the mother's pouch, there suckled, and thus conveyed about three quarters of a year, until it weighs nearly fourteen pounds. We must not forget its "bedpost" tail, which it uses as a third leg in standing upright and in walking. This is the Gigantic Kangaroo, which has bred easily in domestication in this country: a herd of Kangaroos was kept, many years since, in the Royal Park at Richmond, where some produced young ones. The Zoological Society have several specimens. Indeed, Kangaroos have become almost naturalized in this country, being but little affected by change of climate. When placed in a small enclosure, they usually proceed in a circle, seldom crossing from side to side, or moving in any other direction, except to procure their food. There are several varieties: those engraved here are the Major, or Gigantic Kangaroo; the Woolly; and the Wallabee, the latter growing to about sixty pounds' weight. The Kangaroo Rat is the smallest, being about the size of a small rabbit, hopping along like the other Kangaroos, with great speed, and affording good sport in the chase. Few dogs will attack a large Kangaroo singly: some of the largest size frequently

* Mr. Craufurd, the well-known ethnologist, observes: "the Kangaroo was certainly supposed to be an Australian word by Captain Cook, who first used it, and described the strange animal to which it is applied; yet it is strange that no such term is to be found in any Australian language."

hopping off with three or four assailants hanging about them; and one has been known to carry a man some distance. Kangaroos are found in great numbers in Swan River colony.

They have other enemies besides man. When Governor Grey and his party were exploring the Glenelg River, in North-western Australia, one day their attention was drawn to a mis-shapen mass, which came advancing from some bushes, with a novel and uncouth motion. One of the party fired, and the mass fell; when, on going to it, he found it was a small Kangaroo, enveloped in the folds of a large snake, a species of boa. The Kangaroo was quite dead, and flattened from the pressure of the folds of the snake which, being disturbed, began to uncoil itself, when it was shot through the head: it was of a brownish colour, and eight feet six inches long. This Kangaroo was found to be very good eating; and the snake as great a delicacy as an eel.

The Wombat, called by the natives of Port Jackson, the Womback, is a squat, short, thick, short-legged, rather inactive quadruped, somewhat bigger than a large turnspit-dog, and in figure and movements reminding one of a bear. The colour is light sandy-brown, in varying shades. Its pace is hobbling and shuffling, and most men could run it down. It is mild and gentle, as becomes a grass-eater; but it bites hard, and is fierce when provoked. Bass, the navigator, never heard its noise but at that time: it was a low cry, between a hissing and a whizzing, which could not be heard at a distance of more than thirty or forty yards. The first we hear of the Wombat is in a letter of 1798, stating that the animal was found upon an island on the coast of New South Wales, where considerable numbers were caught by the company of a ship which had been wrecked

there on her voyage from Bengal to Port Jackson; it had lately been discovered also in the interior of the country. The flesh of the Wombat is delicate meat, and it has been suggested that the animal might be easily naturalized in this country. From observation of one seen in captivity, it is believed to be of a low grade in point of intellect; and to Mr. Bass' account of the capture of his Wombat is appended this note: "the Kangaroo and some other animals in New South Wales were remarkable for being domesticated as soon as taken." This may be one of the consequences of the low cerebral development to be observed in this group.

Of Edentata, or toothless animals, Australia possesses two genera, the Echnida, or Porcupine Ant-eater; and that most extraordinary animal, the Ornithorhynchus paradoxus. It is found in the Murrumbidgi and other rivers in South-eastern Australia. Its English name is the Duck-bill: on account of its burrowing habits it is called by the colonists the Water Mole; or in Sydney Smith's words, it is "a quadruped as big as a large cat, with the eyes, colour, and skin of a mole, and the bill and web-feet of a duck." Mr. Bennet first saw a living Ornithorhynchus paddling on the surface of a pond on which numerous aquatic plants grew. The slightest noise or movement of the observer's body would cause the instant disappearance of the Duck-bill, so acute is it in sight or hearing, or perhaps in both, and it seldom re-appears when it has been frightened: it dives head foremost with an audible splash; a near shot is necessary, a distant one is almost hopeless upon the loose dense integuments of the body. When the fur is wet, it resembles a lump of dirty weeds. The spur on the hinder feet of the male was long said to contain a deadly poison, which false

idea Mr. Bennet has set at rest by experiment: he could never induce a Duck-bill to make use of its spur. It was long described as *the only mammal which lays an egg.* Mr. Bennet, in his search after the animal, could not trace this to be the case: it is now a clearly ascertained fact, that the young are suckled by their mother, and consequently, it is not at all probable that they are hatched from eggs. A native Australian, when asked on what the young were fed, replied: "All same you white feller, first habe miliken, then make patta (eat) bread, yard," &c. Mr. Bennet, after many fruitless attempts, captured a male and two young ones: they had a most beautifully sleek and delicate appearance, and the young seemed never to have left their burrow: the eyes of the aborigines glistened when they saw the fine condition of the young Mullagongs, as they called them.

Mr. Bennet took his little family of Ornithorhynchi to Sydney: they appeared often to dream of swimming, to judge by the movement of their fore-hands; but they usually reposed side by side, like a pair of furred balls, and awful little growls issued from them when disturbed; at times, they played together, like young puppies. Their eyes being placed so high on the head, they did not see objects well in a straight line, and consequently ran against everything in the room, and upset whatever was easily overturned. They were very cleanly in their habits, and were constantly cleaning their fur, using their hinder feet as a comb. They were frequently found on the top of a chest of drawers in the room; and after much observation, it was proved that the animals had reached this elevated spot by climbing between the back of the drawers and the wall, placing their feet against the wall, and pressing hard with their back

against the back of the drawers. With all the care that could be bestowed upon them, they lived but a few weeks. When first sent to England, the Ornithorhynchus was received by zoologists with caution amounting to suspicion; nor was it until one or two more specimens arrived, that naturalists were ready to allow that the beak was naturally attached to the body: Sir Henry Halford succeeded in establishing the fact of its reality. Two specimens of the Duck-bill were shown in the Great Exhibition of 1851.

The Birds of Australia present some extraordinary specimens of gigantic stature. The Emeu, remarkable for its long, narrow double feathers, in the words of Sir John Herschel, "affords another instance of the singular bizarréries of Australian organization." It has become familiar to us from the frequency of its exhibition in menageries, and its breeding so readily in domestication: it was one of the earliest birds reared by the Zoological Society, at their farm at Kingston, and exhibited in their Gardens in the Regent's Park. In size of bulk, the Emeu is exceeded by the African Ostrich alone; if the Dinornis be extinct. The Emeu is stated by travellers to attain seven feet: in form it closely resembles the Ostrich. It feeds upon fruits, roots, and herbage. In a state of nature it is very fleet, and affords excellent sport in coursing with dogs, which, however, are rather shy of their game, as the bird can kick so powerfully that settlers say it can break the bone of a man's leg by striking out with its feet. Its nest is scarcely known, but it is generally supposed to be a mere hollow excavated in the earth. The dark green eggs are six or seven in number; the male bird sits and hatches the young while the female watches and guards the nest. The birds can produce a

hollow, drumming sort of note. They will take to the water: Captain Sturt, in ascending the Murrumbidgi, saw two Emeus in the act of swimming. They are widely diffused, but gradually disappearing before the encroachments of civilized man. The flesh, particularly the hind quarters, is good and sweet eating. One species only is described; but the indefatigable zoologist, Mr. Gould, concludes that a second species has existed. The Emeus are gregarious, and not very shy: Major Mitchell, in his excursion towards Port Phillip, in one flock counted thirty-nine birds, whose curiosity brought them to stare at the horses of the party, apparently unconscious of the presence of the riders. The Emeu is also found in New Zealand: its feathers are black, smaller and more delicate than those of the Emeu of New Holland; and a mat ornamented with them is the most costly dress that a chief can wear.

The Apteryx of Australia, first described by Dr. Shaw, long remained a very rare bird in museums; but some of the foreign *savans* could scarcely be convinced that such an anomalous form actually existed. Its first aspect has been compared to that of a quadruped; the texture of the feathers, the colour, and the crouching attitude in which it habitually reposes, certainly remind one of a hedgehog: its means of defence are its sharp claws, and it kicks like a cassowary: its habits are strictly nocturnal: during the day, it stands or sits, sleeping and motionless; but during the whole night, it searches actively for food, and travels rapidly from place to place in a shambling gait. When compelled to change its place, from the perpendicular to an oblique direction, the bird supports itself by its hard and bony beak, in addition to its feet. Imperfect vision during the day is com-

pensated by an extraordinary development of the olfactory nerves,—the nostrils are perforated at the very end of the beak. As the Apteryx plunges deeply into the loose earth in search of food, its powers of perception must be vastly increased by the above means; and it is not difficult to understand how effectively the bird must clear every place which it inhabits. Three birds of the Genus Apteryx have been also found in New Zealand; and in 1851, Captain Erskine rendered one of the most interesting services to physiology which can be imagined, by bringing to England the first living specimen of this rare and most singular bird, this link, as it were, between the present and the dim past of a great Polynesian creation, of which New Zealand was the last abiding-place. This specimen is in the Gardens of the Zoological Society.

XVII.

POPULAR ERRORS RESPECTING ANIMALS.

ANIMAL Monstrosities have been strangely misrepresented as vulgar wonders. However capricious Monstrosities may appear, they are now understood to be the necessary results of preceding events. Within the last thirty years several of the laws of these unnatural births, as they used to be called, have been discovered; and it has been proved that so far from being unnatural, they are strictly natural. A fresh science has thus been created, under the name of *Teratology*, which is destroying the old *lusus naturæ* in one of its last and favourite strongholds.*

Blood-spots, assumed, on food have caused much alarm. From the siege of Tyre—when Alexander was alarmed at the appearance of blood-spots on the soldiers' bread—to our time, when a similar phenomenon was noticed at Berlin, public attention has, on various occasions, been attracted by red discolourations in different sorts of food; the credulous have ascribed them to a miracle, while others have referred their pretended appearance to the effect of an excited imagination. But in 1848, Ehrenberg found these blood-spots to be animalcules, which appear as corpuscles, almost round, of $\frac{1}{3000}$ to $\frac{1}{8000}$ of a line in length, transparent when separately examined, but in a mass of the colour of blood. Ehrenberg

* Buckle's Hist. Civilization in England, vol. i. p. 829.

calculates that in the space of a cubic inch there are from 46,656,000,000,000 to 834,836,000,000,000 of these monads.

In connexion with the colour of Animals, Mr. Bates, the "Naturalist on the Amazons," remarks:—"It has often been said, when insects, lizards, snakes, and other animals, are coloured so as to resemble objects on which they live, that such is a provision of nature, the assimilation of colours being given in order to conceal the creatures from the keen eyes of insectivorous birds and other animals. This is no doubt the right view, but some authors have found a difficulty in the explanation on account of this assimilation of colours being exhibited by some kinds and not by others living in company with them; the dress of some species being in striking contrast to the colours of their dwelling-place." Mr. Bates refers to many insects whose abode is the sandy beaches being white in colour—as a large earwig and a mole-cricket. One beetle is coloured to resemble the sand, whilst its sister species is a conspicuous object on the sand; the white species being much more swift of foot than the copper-coloured one. "The margins of these sand beaches are frequented throughout the fine season by flocks of sandpipers, who search for insects on moonlit nights as well as by day. If one species of insect obtains immunity from their onslaughts by its deceptive resemblance to the sandy surface on which it runs, why is not its sister species endowed in the same way? The answer is, that the dark-coloured kind has means of protection of quite a different nature, and therefore does not need the peculiar mode of disguise enjoyed by its companion. When handled, it emits a strong, offensive, putrid, and musky odour, a property which the pale kind does not exhibit. Thus we see that the fact of some species not exhibiting the same adaptation of colours to

dwelling-places as their companion species does not throw doubt on the explanation given of the adaptation, but is rather confirmatory of it."

The Orang-outang is named from the Malay *oran-után*, literally man of the forest, but more correctly a rude or uncivilized man, a savage, a clown, a rustic. The accent, as in nearly all Malay words, is on the penultimate in both words, and not, as we make it, on the last syllable. The naturalists, taking the Bornean individual as the type, establish a class of monkeys under the name of Ourangs; but the propriety of the term is very questionable indeed,—seeing that *orang* means a human being, and is translated by the Latin word *homo*. The name of orang-outang for any kind of monkey is unknown to the Malays,—and the natives of Borneo call the animal *mias*. Such is the conclusion of Mr. Craufurd.

The huge Irish Elk, as it is called,—which is in truth not an elk but a deer—has left its bones in immense quantities in the shellmarl which underlies the peat-bog of Ireland, and elsewhere. This animal was not really so large as those who first discovered its antlers imagined it to have been; for its antlers were not only absolutely, but relatively, larger than is the case in the deer of existing species which are best provided with these formidable appendages.

The reputation of the Lion has suffered much of late years. Probably, there is no animal more associated with popular error than "the King of the Beasts." Dr. Livingston has stripped him of much of his conventional celebrity. "When a lion," he says, "is met in the daytime, (in South Africa,) if preconceived notions do not lead travellers to expect something very noble or majestic, they will merely see an animal somewhat larger than the biggest dog they ever saw, and par-

taking very strongly of the canine features. The face is not much like the usual drawing of a Lion, the nose being prolonged, like a dog's, not exactly such as our painters make it, though they might learn better at the Zoological Gardens, their idea of majesty being usually shown by making their lions' faces like old women in night-caps."

The Badger has been the source of more than one error. It is a vulgar notion, still inveterately maintained, by many who have sufficient opportunities of informing themselves better, that the Badger has the two legs on one side shorter than on the other. This is alluded to as a supposed fact by W. Browne, in *Britannia's Pastorals*, book i. song 4 :—

> And as that beast hath legs, (which shepherds feare,
> Ycleep'd a Badger, which our lambs doth teare,)
> One long, the other short, that when he runs
> Upon the plains, he halts, but when he wons
> On craggy rocks, or steepy hills, we see
> None runs more swift, none easier than he.

Drayton also calls him "the uneven-legged Badger," and speaks of his halting in Noah's flood. And Lyly says in *Midas* :—

> We are not badgers,
> For our legs are one as long as the other.

Sir Thomas Browne, however, corrects the mistake. The popular belief among the peasantry is, that, in running through a ploughed field, the animal always runs with his longer legs in the furrow.

The Mermaid fable has been traced. Professor Owen says: "the popular belief in the existence of 'Mermaids' has, doubtless, been fostered by the two 'herbivorus Cetaceans' of Cuvier—the Manatee and the Dugong. The Manatees

derive their name from the hand-like form of their swimming-paws or fins. They live chiefly on the warmer shores of North and South America, and come on shore to feed, helping themselves on to the beach by their paws. The Dugongs, so called from the Malayian name of one of the species, are found chiefly in the Indian Archipelago and the Red Sea. They do not come on shore, but devour the seaweed which grows along the coast, and their teeth are peculiarly modified for this purpose. The scientific name of the Dugong, *Halicore* (sea-maiden or mermaid) points to the fact that these creatures, as well as the Manatees, have often figured in the wondrous narratives of which old books are full, of strange and unknown creatures rising from the deep."

In the *Penny Cyclopædia, voce* Whale, we read:—"The mammæ of the Manatees and Dugongs are pectoral; and this conformation, joined to the adroit use of their flippers (whose five fingers can be easily distinguished through the investing membranes, four of them being terminated by nails) in progression, nursing their young, &c. have caused them, when seen at a distance, with the anterior part of their body out of water, to be taken for some creature approaching to human shape; so nearly (especially as their muzzle is thick set with hairs, giving somewhat of the effect of human hair or beard) that there can be little doubt that not a few of the tales of Mermen and Mermaids have had their origin with these animals, as well as with Seals and Walruses. Thus, the Portuguese and Spaniards give the Manatee a denomination which signifies Woman-fish [the French call it *Femme Marine*]; and the Dutch call the Dugong *Baardmannetje*, or Little-bearded Man. A very little imagination, and a memory for only the marvellous portion of the appearance sufficed,

doubtless, to complete the metamorphosis of this half-woman or man, half-fish, into a Siren, a Mermaid, or a Merman; and the wild recital of the voyager was treasured up by such writers as Maillet, Lachesnaye-de-Bois, Sachs, Valentyn, and others, who, as Cuvier well observes, have displayed more learning than judgment."

The manufactured Mermaids, and the imposture generally, we have exposed in our *Popular Errors*, pp. 123-125. Among the recent evidence is that of two fishermen, who, on June 4, 1857, on the Argyleshire coast, on their way to the fishing-station, Lochindale, in a boat, and when about four miles south-west from the village of Port Charlotte, being then about 6 P.M., distinctly saw an object about six yards distant, in the shape of a woman, with full breast, dark complexion, comely face, and fine hair hanging in ringlets over the neck and shoulders. It was above the surface of the water to about the middle, gazing at them, and shaking its head. The weather was fine, and they had a full view of it, and that for three or four minutes. This declaration was properly attested!

Sir Stamford Raffles says the Mermaid is frequently seen on the coasts of Sumatra; but his report of her appearance is far different from, and much less poetic than, the fabulous histories. He describes her appearance as very like that of a cow, and says he cannot conceive how any resemblance to a woman can have been fancied, excepting in the position of the breasts and in the manner of nursing her young. They have a very strong affection for their young, and when these are removed, call them with a loud, continual moan, very discordant, and which is the far-famed Mermaid's song. This moan is sometimes accompanied by tears, and a strange pro-

perty is ascribed to those tears by a kind of poetic superstition. It is supposed that the tears which the mother sheds to recall her absent offspring have the power of attracting towards the person possessing them the *one* most dear to that person. The precious drops are, therefore, eagerly purchased by lovers, as a kind of talisman to preserve and retain the affections of the beloved object!

The War of Extermination that has been raised against Small Birds of late years has shown how much ignorance prevails upon the Habits of Birds. Clubs have been formed for their destruction, in consequence of their consumption of ripe crops. Now, the harm may be considerable, but the farmer is more than compensated by the benefits of the bird; actual and careful observation proving that the sparrow is most useful in killing, for food, flies, caterpillars, wire-worms, &c., which commit immense ravages among the products of the land. It has been calculated that a single pair of sparrows, during the time they have their young to feed, destroy above three thousand three hundred caterpillars in a week, besides other insects. Mr. Jesse, in his *Country Life*, relates that a Correspondent has attached to his garden a fruit-plantation of three acres, containing gooseberries, currants, raspberries, cherries, apples, pears, plums, &c., and that he *never allows birds to be destroyed, or their nests taken.* The consequence is, that he is never annoyed with caterpillars. Yet, in Mr. Jesse's neighbourhood, where a Bird Club is in full activity, caterpillars devastated an apple-orchard so unsparingly, that women were employed to pick off every blossom, in order to save the trees. Then, we read of a gentleman protecting some choice gooseberry-bushes with a stout wire awning, to shield them from the attacks of the sparrow and

his companions; but he had also protected the caterpillars from the birds; so they had the fruit to themselves, and at the ripening season, he found, to his annoyance, that the caterpillars had feasted free from all interruption, and both leaf and fruit had disappeared. Caterpillar is the name applied to the larva state of butterflies and moths. An ingenious and probable derivation of the word is given by Mr. Duncan, in Sir William Jardine's *Naturalists' Library:* British Butterflies, vol. iii. It is as follows:—The origin of this word is not very obvious, but it no doubt refers to the destructive propensities of the larva. The most probable derivation is that which assigns it to the two old French words, *acat*, food or provisions, more recently written *cates*, as in *Paradise Lost*:—

> Alas! how simple to these cates
> Was the crude apple that diverted Eve!

—and *piller*, to rob or plunder, whence also we have the word "pillage."

The Hybernation of Swallows, or in plainer words, what becomes of them in winter, has excited among naturalists much controversy and speculation, suggestive of many ingenious theories and contradictory evidence. That the bird can hide *under water*, except temporarily, or for a short submersion, is inconceivable;—more especially for the winter season, since no warm-blooded or quick-breathing animal either can or does so hybernate. Yet, we have the following testimony of a prelate, upon the question:—

"On the 2d of November, 1829, at Loch Ransa, in the island of Arran, a man, while digging in a place where a pond had been lately drained off, discovered two swallows in a state of torpor. On placing them near the fire, they recovered." *

* Bishop Stanley's History of Birds.

Similar instances of the dormant habitation of birds in mud deposits and manure-heaps during the winter season, and of their re-animation on being brought into a higher temperature, are also on record. Gilbert White believed that swallows "do not depart from this island, but lay themselves up in holes and caverns; and so, insect-like and bat-like, come forth at mild times, and then retire again to their *latebræ*." The Rev. Mr. Fleming, the zoologist, asks how the swallows, which are much lighter than water, can sink in clusters, as they are represented to do; and if so, how their feathers resist six months' maceration in the water, and appear in spring as fresh and glossy as other birds'? In the case of other torpid animals, some vital actions are performed, and a portion of oxygen is consumed; but in the submerged Swallows, respiration, and consequently circulation, must cease. Other torpid animals, too, in retiring to their winter slumbers, consult safety; while the Swallow, in sinking under the water, rushes to the place where the otter and the pike commit their depredations.

It is now ascertained that migration is, in ordinary cases, practised by Swallows; yet their submersion has been believed by many naturalists, such as Klein, Linnæus, and others.

Montague considers the idea of the submersion of the Swallow too extravagant to need refutation. Still, the belief that the Swallows hide themselves during the winter at the bottom of rivers and lakes is prevalent to this day in some parts of England; and Mr. Jesse was assured upon credible authority, that a person in the neighbourhood of Grasmere Lake had seen Swallows emerging from it.

A Correspondent of *Notes and Queries*, writes:—"A North American gentleman, attracted one day, late in the autumn

season, by the gathering of a large body of Swallows over a particular spot, and having been told that Swallows had been seen to dive into a mill-pond and disappear, watched their operations, which, after a few significant circumvolutions, were closed by a simultaneous rapid descent into a hollow sycamore tree six feet in diameter. The tree was felled the following year, and revealed the *débris* of bones, feathers, and other remains of such birds as had not survived, through age or weakness, to renew their spring migrations."

The Goose has been most unjustly called a "stupid bird," and the trustworthiness of classic history has been impeached in support of this imputation. The historical credit of the received story respecting the preservation of the Roman Capitol by the cackling of Geese depends in great measure upon the vigilant habits of this bird, and its superiority to the dog as a guardian. The alertness and watchfulness of the Wild Goose, which have made its chase proverbially difficult, appears, from the following testimony, to be characteristic of the bird in its domesticated state; the establishment of which fact unquestionably confirms the traditionary account of their preservation of the Capitol. The following is the evidence, with which a Correspondent of *Notes and Queries* has been favoured by Professor Owen, from Richmond Park :—

"Opposite the cottage where I live is a pond, which is frequented during the summer by two brood-flocks of Geese belonging to the keepers. These geese take up their quarters for the night along the margin of the pond, into which they are ready to plunge at a moment's notice. Several times when I have been up late, or wakeful, I have heard the old gander sound the alarm, which is immediately taken up, and has been sometimes followed by a simultaneous plunge of the

flock into the pool. On mentioning this to the keeper, he, quite aware of the characteristic readiness of the Geese to sound an alarm in the night, attributed it to a foumart or other predatory vermin. On other occasions the cackling has seemed to be caused by a deer stalking near the flock. But often has the old Roman anecdote occurred to me, when I have been awoke by the midnight alarm-notes of my anserine neighbours; and more than once I have noticed, when the cause of alarm has been such as to excite the dogs of the next-door keeper, that the Geese were beforehand in giving loud warning of the strange steps.

"I have never had the smallest sympathy with the sceptics as to Livy's statement: it is not a likely one to be feigned; it is in exact accordance with the characteristic acuteness of sight and hearing, watchfulness and power, and instinct to utter alarm-cries, of the Goose."

The elevated and marshalled flight of Wild Geese seems dictated by geometrical instinct: shaped like a wedge, they cut the air with less individual exertion; and it is conjectured that the change of the form from an inverted V, an A, an I, or a straight line, is occasioned by the leader of the van quitting his post at the point of the angle through fatigue, and leaving his place to be filled by another, himself dropping into the rear.

The Martin, which in England is considered as bringing good fortune to the house under the eaves of which it builds its nest, is regarded as a bird of ill-omen in the Feroe Islands; it never builds here, and the islanders dread its appearance, believing either that there will be a destructive sickness in the country, or that a corpse will soon be carried from the house over which it happens to fly.

The Voice of Fishes has been impugned: but anglers, of our time, have proved that Tench croak like Frogs; Herrings cry like mice; Gurnards grunt like hogs; and some say that Gurnards make a noise like a cuckoo, from which it takes one of its country names. The Maigre, a large sea-fish, when swimming in shoals, utters a grunting or piercing noise, that may be heard from a depth of twenty fathoms. The river Plate swarms with fish, and is the *habitat* of one possessed of a very sonorous voice: an officer of H.M.S. *Eagle,* during his service, heard a loud chorus of these fish at three miles' distance.

Can Fishes hear? is often asked: as they have no external ears, sound must be conveyed through the bones of the head; but they are, probably, insensible to, or habitually careless of, those feeble sounds which are communicated from the air. Thus, gold or silver fish in a glass vase will be utterly insensible to any sound excited in the air outside the vessel; but, if you tap with the nail on the edge of the vase, even if the motion be not seen by the fish, they will immediately be disturbed.

Whether a Trout can hear is a much-vexed question with anglers: it seems evident that no noise made out of the water can be heard by a trout in it. Guns have been fired not many yards from trout, but they exhibited no symptoms of alarm; and though some English works upon angling caution the angler against speaking aloud at the water side for fear of alarming the fish, this much is certain, that neither by speaking, nor any other noise the angler can make, is there the least danger of alarming them. They have frequently been caught below a railway-bridge, at the very time a train was passing overhead.

The Tench was formerly supposed to have some healing qualities in his touch, though by no means commended as wholesome food. Isaac Walton says:—"The Tench is *the physician of fishes*, for the Pike especially; and the Pike being either sick or hurl, is cured by the touch of the Tench. And it is observed that the tyrant Pike will not be a wolf to his physician, but forbear to devour him, though he be never so hungry." He adds: "this fish that carries a natural balsam in him to cure both himself and others, loves yet to feed in very foul water, and among weeds." Walton also quotes from Rondeletius a great cure done at Rome, "by applying a Tench to the feet of a very sick man." The physicians, however, held Tench to be unwholesome food; and Dr. Caius calls them "good plasters but bad nourishment, for being laid to the soles of the feet, they often draw away the ague."

Tench was also formerly recommended as a sovereign remedy for jaundice; and, it is probable that the golden colour of the fish, when in high season, induced the ignorant to suppose that it was given by Providence, as a signature to point out its medicinal quality.

More nonsense has been uttered about the Herring than about all the other fish in creation: the absurdities being of almost every kind—scientific, historical, commercial, and political. Thus, naturalists declare that the Herring goes to the Arctic Seas to spawn, and there remains for months afterwards, in order to recruit its strength. Next, the curious stories of the wealth which this little fish has created, and of its vast importance to human nature, are in part fictitious. We hear of Amsterdam being built on herring-bones, and that every fifth inhabitant of Holland was, at one time,

engaged in the herring fishery. This, we need scarcely say, is a ridiculous hoax. Our herring fisheries are now a valuable property, in which altogether, from two to three millions of money are sunk; and this importance has led to the appointment of a Commission to report on the Natural History of the Herring, and the operation of the Acts of Parliament relating to the modes of fishing; the following are the leading points of the Report:

The Herring does not, as some naturalists have affirmed, migrate to the seas within the Arctic circle, but probably, on disappearing from our shores, passes into deep water near them. The Herring is found under four different conditions:—1st, Fry or Sill; 2d, Maties, or Fat Herring; 3d, Full Herring; 4th, Shotten or Spent Herring. It is extremely difficult to obtain satisfactory evidence as to the length of time which the Herring requires to pass from the embryonic to the adult or full condition. The fishermen examined on this point differed in opinion,—some considering that the Herring takes three years, others seven years. Mr. Yarrell's statement, that the Herring attains to full size and maturity in about eighteen months, is probably correct. It is also probable that this fish arrives at its spawning condition in one year, and that the eggs are hatched in, at most, two or three weeks after deposition, and that in six or seven weeks more the young have attained three inches in length. The Maties, or fat Herring, feed, develop their reproductive organs, and become full Herrings in about three or four months,—the full Herring appearing at first only scattered here and there among the shoals, but gradually increasing in number until they largely preponderate over the Maties, or almost entirely constitute the shoal. The Herrings then aggregate in prodigious

numbers for about a fortnight in localities favourable for the reception of their ova. Here they lie in tiers, covering square miles of sea-bottom, and so close to the ground that the fishermen have to practise a peculiar mode of fishing in order to take them; while every net and line used in the fishing is thickly covered with the adhesive spawn which they are busily engaged in shedding. So intent are the fish on this great necessity of their existence that they are not easily driven from their spawning-ground; but when once their object has been attained and they have become spent fish the shoal rapidly disappears, withdrawing in all probability into deep water at no great distance from the coast. There is no positive evidence as to the ultimate fate of the spent Herrings; but there is much to be said in favour of the current belief, that after a sojourn of more or less duration in deep water they return as Maties to the shallows and lochs, there to run through the same changes as before. The Commissioners were unable to gain any information respecting the time which one and the same Herring may pass through the cycle. The enemies of this fish are, however, too numerous and active to render it at all likely that the existence of any one fish is prolonged beyond two or three reproductive epochs. The conclusion is, that the Herring spawns twice annually, in the spring and in the autumn.

The food of the Herring consists of crustacea, varying in size from microscopic dimension to those of a shrimp, and of small fish, particularly sand-eels. While in the matie or fat condition, they feed voraciously; and not unfrequently their stomachs are found immensely distended with crustacea and sand-eels, in a more or less digested condition. Herrings thus gorged have all their tissues so permeated with fat, that they

will not cure well, and their flesh is liable to break when handled. Scotch fishermen call these fish "gutpock" Herrings, and consider them of very inferior quality.

The remarkable variableness in the annual visits of shoals of Herrings to our coasts is to be ascribed to the varying quantity of food of the fish, and to the number and force of the destructive agencies at work. Any circumstance which increases or decreases the quantity of crustacea and sand-eels must exercise great influence on Herring shoals; but these are even more acted upon by their great destroyers. The latter may be ranged under the heads of fish, birds, marine animals, and man. Of these by far the greatest destroyers are fish and marine animals—as porpoises and other cetacea. It is estimated that the total annual take of Herrings by our fishermen is 900,000,000: a prodigious number; but great as this is, it sinks into comparative insignificance when compared with the destruction effected by other agencies. Cod alone destroy ten times as great a number as are captured by our fishermen. It is a very common thing to find a cod-fish with six or seven large Herrings in his stomach. When it is further considered that the conger and dog-fish do as much mischief as the cod and ling, that the gulls and gannets slay their millions, and that porpoises and grampuses destroy additional countless multitudes, it will be evident that our fishing operations, extensive as they are, do not destroy 5 per cent. of the total number of full Herrings that are destroyed every year by other causes. These facts, which cannot be controverted, prepare us for the conclusions arrived at by the Commissioners with reference to the legislative enactments relating to our Herring fishery. This *précis* is from the *Athenæum* journal.

With regard to the alterations in the Laws, the Report

recommends that our Herring fishery should not be trammelled by repressive Acts, calculated only to protect class interests, and to disturb in an unknown, and possibly injurious, manner the balance existing between the conservative and destructive agencies at work upon the Herring. If legislation could regulate the appetites of cod, conger, and porpoise, it might be useful to pass laws regarding them; but to prevent fishermen catching 1 or 2 per cent. of Herring in any way they please, seems, in the opinion of the Commissioners, a wasteful employment of the force of law.

The Crocodile is said by Pliny, and other authors, to have a defective sight under water, which a moment's consideration, without the necessity of personal experience, should have corrected; for it is at least reasonable to suppose that an animal living chiefly on fish should, in order to secure its prey, be gifted with an equal power of sight; and that of fish cannot be said to be defective; but Herodotus, the *father* of these errors, affirms that it is totally blind. Sir Gardner Wilkinson, in his *General View of Egypt*, says: "The Crocodile covers its eye at pleasure with the nictitating membrane. It has no tongue, and moves the upper jaw. It does not run very quick, but can turn round in an instant." On either side of the underpart of the lower jaw of the Crocodile is a small opening, from which the creature can force at will, a liquid possessing the smell of musk. This property was first noticed by Mr. Thomas Bell, in the *Philosophical Transactions;* and he is of opinion that the reptile employs it for the purpose of attracting fish into the places which it haunts.

The Crocodile's Eggs are hard, and as large as those of the goose, but of different shape, oblong rather than oval. The

animal was held sacred by the Egyptians, and even elevated by them to the rank of a deity, for it was certainly one of the symbols of Typhon. While it was worshipped in one part of Egypt, under the name of *Suchus* or *Souchis*, it was eaten at Elephantine. M. Champollion, the younger, states that the Egyptians gave the name of *Souk* to a deity which they represented as a man with a Crocodile's head. Cuvier considers that only one species of Crocodile was sacred, as was the case with the deified bull. Geoffroy St. Hilaire* is of a

* A statue of this great Naturalist and Philosopher has been erected at Etampes, his native place, about forty miles south from Paris. Three distinguished *savans*, Dumeril, Serres, and Milne Edwards, attended the inauguration, and delivered short addresses, commemorating the talents and labours of Saint Hilaire. In 1793, at the early age of twenty-one, he was appointed Professor of Zoology by the recommendation of Hauy and Daubenton. When his nomination was announced to him by the latter, he replied :—"How am I to teach a science that does not exist?" "True," said Daubenton, "it does not exist; it must be created; let the bold task be yours, and yours the glory of enabling us to say, twenty years hence, that France has created zoology." He devoted himself to the work with enthusiasm, and the product of his labours appeared in a long succession of Memoirs which were afterwards embodied in his voluminous *Histoire Natural des Mammifères.* He laboured zealously to enrich the Museum, or Cabinet of Natural History, and to enlarge the menagerie. He was one of the *savans* selected to go with Bonaparte to Egypt, where he employed himself with great diligence in collecting specimens of the higher animal tribes from the Delta of the Nile to the cataracts, and along the shores of the Red Sea. When Egypt was conquered by the British, his collections and those of the other *savans* were claimed by a commissary as part of the victors' spoil. "*We will burn them sooner than suffer them to be taken from us* (said Geoffroy), *and write on your forehead the brand of Omar, whose name glares on posterity through the flames of the Alexandrian Library.*" The claim thus roughly repelled was not persisted in, and the treasures gathered in Egypt formed the base of great scientific collections now seen in Paris. Geoffroy continued his labours on his return to France, and fully realized the anticipations of Daubenton; but we must give the result in the words of M. Serres, so characteristic of the taste of our vivacious neighbours. "Geoffroy

different opinion: he observes also that the Crocodile still bears in Egypt the name of *Temsâ*, which M. Champollion thought he recognised upon many papyri as *mshah*, a word which he regards as formed of the preposition *m*, in, and the substantive *sah*, egg. The Egyptians ornamented their tame Crocodiles by hanging rings of gold and precious stones from their ears, which they pierced for the purpose; they also adorned their fore-feet with bracelets, and presented them in this finery to the veneration of the people. They likewise fed them well: cake, roast meat, and mulled wine were occasionally crammed and poured down their throats. From Pliny we learn that the Romans first saw them in the Ædileship of Scaurus, who showed five. Augustus introduced thirty-six of them into an amphitheatre at one time, when they were all killed by gladiators. It is said that the Crocodile is no longer seen in the Delta, but that it is found, sometimes in great numbers, in the Thebaid and the Upper Nile.

The implied sacredness here referred to reminds us of a remarkable instance in the Quail. Mr. Yarrell, in his excellent work on British birds, proves that the common Quail was the food of the Israelites in the wilderness. It is the only species that migrates in enormous multitudes, or indeed that migrates at all. The instinct of the bird was therefore made use of by the Almighty to supply the wants of His famishing people; "and it affords," says Mr. Yarrell, "a proof of the perpetuation of an instinct through a period of 3000 years." It does not pervade a whole species, but that part of a species existing within certain geographical limits;

l'entreprit (the task of creating the science) et les vingt années, n'étaient pas écoulées, que l'Europe savante *inscrivait la Zoologie au rang des titres glorieux de notre nation, déjà si plein de gloire*."—*The Scotsman.*

an instinct characterized by a peculiarity, which modern observers have also noticed, of making their migratory flight by night. We read in the sixteenth chapter of Exodus: "And it came to pass that at even (probably night) the quails came up and covered the camp." Thus we see the most ancient of all historical works and natural history each throwing light on the other.

The old notion that the Crocodile sheds tears, notwithstanding its ferocity, has given to our language the epithet "crocodilian," deceitful. Quarles, in his *Emblems*, has:

> O what a crocodilian world is this,
> Compos'd of treacheries and insnaring wiles;
> She cloaths destruction in a formal kiss,
> And lodges death in her deceitful smiles.

Foote, in one of his farces, has that incarnation of deceit, "Kitty Crocodile." But the "Tears" have been explained. Lactation by the crop of pigeons has been proved by naturalists; and Mr. Jesse considers that the crop is gradually thickened, and the glands are enlarged, during the period of incubation in most birds, just as the milk-glands are prepared during gestation in mammalia: hence the curdy substance or milky secretion of pigeons; and Mr. Gulliver has shown that a process like that which takes place in the crop of pigeons has been discovered in the female Crocodile. Thus the old popular saying about "Pigeon's Milk," which was a sort of April-fool's errand, had some foundation for it, and proves that a degree of truth generally lurks in the adages of our ancestors. It may also possibly turn out that whatever horror people may have of "Crocodile Tears," the reptile secretes the bland milk for its tender young.*

* Popular Errors Explained and Illustrated, p. 100.

Recently, an ingenious attempt has been made to identify the dragon of fable with the Crocodile. M. de Freminville cites many known facts of natural history, to prove that there is no reason to believe that crocodiles never inhabited western Europe merely because we do not now find them there. And, above all, he adduces the fact that, in the sand at the mouth of the Seine, at Harfleur, and Quillebœuf, entire skeletons of Crocodiles have been found in a state only half fossilized. From all which he concludes, that the continual battles of the heroes of the middle ages with dragons were in truth real encounters with Crocodiles.*

The Leviathan is thus illustrated by Dr. Lewysohn, who, in his *Zoologie des Talmuds*, gives some idea of the opinions of the Jews on this subject; in which we see something akin to classic and Scandinavian mythology:

"The Leviathan (says Dr. L.) is usually regarded either as a twisted serpent, or as *a crocodile*. The Talmud, however, makes of it a fabulous monster. The female lies in a circle round the earth like a girdle. But since there was reason to fear that its offspring might destroy the world, God killed the female, and mutilated the male. The flesh of the female is salted and preserved for the banquet which will be prepared for the pious at the last Great Day. The angel Gabriel will one day put the male to death, and a tent will be made of its skin for the use of the holy at the banquet in question."

This opinion is alluded to in 2 Esdras vi. 52:—

"But unto Leviathan thou gavest the seventh part, namely the moist; and hast kept him to be devoured of whom thou wilt and when."

* Trollope's Tour in Brittany, vol. ii.

The *Plain Commentary* on Ps. lxxiv. 14 :—"Thou brakest the heads of Leviathan in pieces, and gavest him to be meat to the people inhabiting the wilderness," says :—

"He smote down and crushed Pharaoh, as a hunter smites down the ravening Crocodile ; and the dead bodies of the Egyptians, once so strong and proud, were cast upon the sea-shore for a prey to the wild beasts that people the wilderness of Arabia."

Adding, however, a note referring to the tradition of the Talmud, that the Leviathan was to form a banquet for the elect at the Last Day.

The Jews have a tradition that "a pair of these animals were originally created, male and female ; but that the male was consumed for food by the Jews during their wanderings forty years in the wilderness ;" as referred to in Psalm lxxiv. 14 :—"Thou brakest the heads of Leviathan in pieces, and gavest him to be meat to the people inhabiting the wilderness"—a text which is generally considered to refer to the destruction of the Egyptian host in the Red Sea, and their carcases becoming a prey to the birds and beasts of the neighbouring desert.

The Slow-worm has been misunderstood through its name. This is thought to be a modification of the following couplet, frequently quoted by the peasantry in Norfolk :—

> "If the snake could hear, and the slow-worm see,
> Neither man nor beast would e'er go free."

Dr. Seaton notes :—"The Slow-worm (*anguis fragilis*), or blind-worm, is believed to be venomous, and consequently a war of extermination is waged against it, although its sting is as fabulous as its blindness."

The Toad has a very strange economy. It is an ancient

and common opinion that Toads and Salamanders possess a subtle venom; this, however, has generally been deemed fabulous by persons engaged in scientific pursuits. MM. Gratiolet and Cloez, however, have proved to the French Academy that there is foundation for the current belief, and that Toads and Salamanders do secrete a deadly poison. From the dorsal and parietal pustules of these animals was taken a milky fluid, with which were inoculated some small birds, upon whom the poison produced fatal effects in a short space of time. A turtle-dove, wounded in the wing with the liquid from the Salamander, died in convulsions, in eight minutes. Five small birds, inoculated with the lactescent humour of the Toad, died in five or six seconds, but without convulsions. This liquid of the Toad, even after being dried, kills birds, though not so rapidly as when fresh. Some mammiferous animals were experimented on and had convulsions, but they were not mortal. It is said that in Scotland, during the time of harvest, the Toad's mouth is shut, and is then quite harmless, not being able to discharge its venom. An idea is universally prevalent among the vulgar that this reptile is very poisonous, and they kill it whenever they can; but, acting upon the notion that they cannot emit their poison in the harvest time, reapers are not afraid to handle them at that time, and believe that if a sprained wrist is rubbed with a live Toad it will effect a cure.

Advantage has been taken of the insect-eating propensities of the animal. A gentleman had killed a Toad, and after skinning it, for the purpose of stuffing the skin, he dissected its digestive system. The stomach contained a mass of insects, some of them very rare and in good preservation. Afterwards he was accustomed to kill Toads for the express purpose

of collecting the insects that were found within them, and which, being caught during the night, were often of such species as are not often found.

The same experiment elicited another curious fact, namely, the great tenacity of life possessed by some insects. Before pinning out the insects that were found, and which were mostly beetles, they had been allowed to remain in the water for several days, and were apparently dead. Yet, when they were pinned on cork, they revived; and when they were visited, were found sprawling about in a lively manner!

The question, Can Frogs and Toads live in blocks of stone or wood? has been settled at page 45 in the negative. However, the evidence continues to accumulate. Sir Alexander Gordon Cumming, of Altyre, while inspecting the railway works at that place in 1864, saw "numbers of living Toads taken out of the conglomerate at depths of from fifteen to twenty-four feet from the surface: an extensive, and seemingly *unbroken*, bed of rock covers the stratum in which these living Toads were found. When the rock was blasted, the Toads were found imbedded in holes, like a hen's egg, cut lengthwise in half."

Mr. Gosse, in the second series of his *Natural History*, tells us that in digging, or rather blasting a well in Khandeish, in the south of India, the workmen reached a moist rock, within which were Frogs; that two of them were released out of a block of paved rock, and water was found there, at about thirty-five feet from the surface. Mr. Gosse adds: "Wherever water percolates, Tadpoles may be conveyed, as also air and infusoria for their support in their advanced stage of existence; and, no doubt, nature enables the Frog to secrete solvents, enabling it to increase its mansion;

for, otherwise, how could the Blois Toad have prevented the process of silicification within the flint in which it was inclosed?"

The Salamander was a name applied by the ancients to a fabulous creature, which was supposed to possess the power of existing in the midst of flames, and even of quenching the fire by which it was surrounded. In our own times, a strange belief has existed among the ignorant, that if any fire remains unquenched for the space of seven years, a Salamander will be produced. But the inquiries of modern science have shown that the only foundation for all these fables is the means of self-defence granted to this harmless reptile by the Creator.

The body of the Salamander is covered with pores, from which, when alarmed, or suffering from pain, an acrid, watery humour exudes, which is at times so far able to quench the fury of the flames as to give the poor creature time to escape, and in this single fact consists the whole of the mysterious power that has been attributed to it. The experiments of Spallanzani on the astonishing power of the Salamander in reproducing a limb have rendered it famous. The same limb can be reproduced several times in succession after it has been cut off, that with all its bones, muscles, &c. Another faculty, not less singular, is that of remaining a long time encompassed with ice without perishing.

That "Horsehairs, though lifeless, yet lying nine days under water, turn to snakes," is an old superstition believed only by the most credulous wonder-seeker. It is curious to find that the poets-laureate, William Wordsworth, and his predecessor, Robert Southey, neither of them men who were easily to be imposed upon, gave credence to this strange metamorphosis.

"You must have heard," says the latter, in a letter to his brother, Dr. Southey, "the vulgar notion that a horsehair plucked out by the root, and put in water, becomes alive in a few days. The boys at Brathay repeatedly told their mother it was true; that they had tried it themselves, and seen it tried. Her reply was, 'Show it to me, and I will believe it.' While we were there last week, in came Owen, with two of these creatures in a bottle. Wordsworth was there; and to our utter unutterable astonishment did the boys, to convince us that these long thin black worms were their own manufacture by the old receipt, lay hold of them by the middle, while they writhed like eels, and stripping them with their nails down each side, actually lay bare the horsehair in the middle, which seemed to serve as the backbone of the creature, or the substratum of the living matter which had collected round it.

"Wordsworth and I should both have supposed that it was a collection of animalculæ round the hair, (which, however, would only be changing the nature of the wonder,) if we could in any way have accounted for the motion upon this theory; but the motion was that of a snake. We could perceive no head; but something very like the root of the hair, and for want of glasses, could distinguish no parts. The creature, or whatever else you may please to call it, is black or dark-brown, and about the girth of a fiddle-string. As soon as you have read this, draw upon your horse's tail and mane for half-a-dozen hairs; be sure they have no roots to them; bottle them separately in water, and when they are alive and kicking, call in Gooch, and make the fact known to the philosophical world. Never in my life was I so astonished as at seeing what in the act of seeing I could scarcely believe and now almost doubt. If you verify the experiment, as

Owen and all his brethren will swear must be the case, you will be able to throw some light upon the origin of your friend, the tape-worm, and his diabolical family."*

A Correspondent, who sends the above to *Notes and Queries*, made the experiment, "but the result was, in all respects, the reverse of what the letter-writer records;" and he thinks that the poets were the victims of a practical joke.

Respecting the generation of the eel, there have been the wildest and most ridiculous notions. One ancient author supposed that eels were born of the mud; another, that they were produced from particles scraped from the bodies of large eels when they rubbed themselves against stones—that they grew out of the putrid flesh of dead animals thrown into the water—from the dews which cover the earth in spring and summer—from water, and so forth. Among modern writers, we have the same confusion of theories. There is a popular notion in many districts of the north of England, that eels are generated from horse-hairs deposited in springs and rivulets. A German author mentions that they owe their origin to electrical phenomena; but he is sadly at a loss about substantiating his theory by facts. The great naturalist, Buffon, is said to have remarked, in the latter part of the last century, at a meeting of French *savans*, that he considered the question as to the generation of eels to be one of the most puzzling in natural history. The Bishop of Norwich, Dr. Kay, read a paper to the Royal Society on this subject. He noticed some small eels in the thatch of a cottage; and he endeavoured to establish the proposition that the spawn of the fish had been deposited on the reeds before they were cut, and had been subsequently vivified by the sun's rays.

* Life and Correspondence of Robert Southey, 1850, vol. iv. p. 36.

XVIII.

PLAGUES OF ANIMALS.

AMONG the earliest visitations are the Plagues of Egypt, which exhibited a series of phenomena, rising in progression from the corruption of rivers and fountains, swarms of insects, murrain among cattle, thunder and thick darkness, and a tribe of inferior diseases, to that which swept away the first-born of the Egyptians. Cowley, in his Pindarique Ode, thus sings of the appearance of Frogs from the Nile:—

The river yet gave one instruction more,
And from the rottin fish and unconcocted gore,
Which was but water just before,
A loathsome host was quickly made,
That scal'd the banks, and with loud noise did all the country invade.

As Nilus, when he quits his sacred bed,
(But like a friend he visits all the land
With welcome presents in his hand)
So did this living tide the fields o'erspread.
In vain the alarmed country tries
To kill their noisome enemies,
From th' exhausted source still new recruits arise,
Nor does the earth these greedy troops suffice.
The towns and houses they possess,
The temples and the palaces,
Nor Pharaoh nor his gods they fear;
Both their importune croakings hear.

> Unsatiate yet they mount up higher,
> Where never Sun-born Frog durst to aspire,
> And in the silken beds their slimy members place;
> A luxury unknown before to all the wat'ry race.

In the Notes to the Ode the origin of this visitation is thus explained by Cowley:—"When the water had been corrupted with blood, (which, when it corrupts, boils, and burns as it were, in the veins,) it is no wonder if it produced a great number of frogs; but the wonder consists in that the number was so infinite, in that it was so suddenly produced by the action of Aaron, and that, contrary to their nature, they came to molest the Egyptians in their very houses. The like judgment with this we find in profane histories, and to be attributed to the same Hand of God, though the rod was invisible. Athenæus, in his eighth book, chap. 2, reports, that in Pæonia and Dardanium (now called Bulgaria), there rained down so many frogs from Heaven (that is, they were suddenly produced after great showers,) that they filled the public ways, and even private houses, that their domestic furniture was covered with them, that they found them in the very pots where they boiled their meat; and that what with the trouble of the living, and the smell of the dead ones, they were forced at last to forsake their country. And Pliny reports, in his eighth book, that a whole city in Gallia hath been driven away by frogs, and another in Africk, by locusts; and many examples of this kind might be collected."

In one the French *Anas*, 1797, "the Cause of the Appearance of young Frogs after Rain" is thus described:—"Frogs are produced in the same manner as other oviparous animals. The female lays her eggs, and deposits them

in holes of the earth, where she nurses them as toads do their young ones. After great rains, the water, deluging the little caverns in which they lay their nests, obliges them to leave them to prevent destruction. This sudden appearance of frogs, after a great deal of rain, induced the common people to imagine that they were engendered in the rain, and so came down from the skies. In Lapland, the sudden appearance of rats, bred in the mountains, after heavy showers, gave rise to the same opinion in that country concerning their generation."

Cowley, in the Ode just quoted thus describes the devastations of Locusts:

> "Lo, a scorching Wind from the burnt countries blew,
> And endless legions with it drew
> Of greedy Locusts, who where'er
> With sounding wings they flew,
> Left all the earth depopulate and bare,
> As if Winter itself had march'd by there."

"Wonderful are the things which Authors report of these kind of armies of Locusts, and of the order and regularity of their marches. Aldrovandus and Fincelius, (as I find them cited,) say thus: that in the year 852 they were seen to fly over twenty miles in Germany in a day, in the manner of a formed army, divided into several squadrons, and having their quarters apart when they rested. That the Captains, with some few, marched a day's journey before the rest, to choose the most opportune places for their camp. That they never removed till sun rising, and just then went away in as much order as an army of men could do. That at last, having done great mischief wherever they passed, after prayers made to God, they were driven by a violent

wind into the Belgick Ocean, and there drowned, but being cast again upon the shore, caused a great pestilence in the country. Some add that they covered 140 acres at a time. St. Hier, upon Joel, speaks thus: When the armies of Locusts came lately into these parts, and filled all the air, they flew in so great order, that slates in a pavement cannot be laid more regularly, neither did they ever stir one inch out of their ranks and files. There are reckoned thirty several sorts of Locusts, some in India (if we dare believe Pliny) three foot long. The same author adds of Locusts (Lib. XI. cap. 29), that they pass in troops over great seas, enduring hunger for many days together, in the search of foreign food. They are believed to be brought by the anger of the gods; for they are seen sometimes very great, and make such a noise with their wings in flying, that they might be taken for birds. They overcast the sun, whilst people stand gazing with terror, lest they should fall upon their lands. Out of Africk, chiefly they infest Italy, and the people are forced to have recourse to the Sibyl's books, to inquire for a remedy. In the country of Cyrene there is a law to make war against them thrice a year, first by breaking their eggs, then by killing the young ones, and lastly, the old ones," &c.

Nor are records of these visitations to be met with only in ancient history. Almost at the moment we write, the famous kingdom of Syria has been visited by a most destructive plague of Locusts. An accredited eye-witness, in April, 1865, observed, at Jaffa, large dark clouds which, on descending, were seen to be Locusts, so great in number that the whole land was covered with them, yet they did not touch the nearly ripe grain, or any other vegetation. Soon after, the locusts buried themselves in the soil, and there deposited innumerable eggs: incredible numbers were dug out, and destroyed.

About the middle of May, small black creatures, at a distance resembling large ants, were observed accumulating in large heaps throughout the country; a few days after they had been thus seen they began to leap, and manifested the coming calamity and invasion of the fearful army, as described so emphatically in Joel ii. The people now began to sweep them together and bury or burn them in ditches dug for the purpose, but all to little or no diminution. The roads were covered with them, all marching in regular lines, like armies of soldiers, with their leaders in front; and all the opposition of man to arrest their progress was in vain.

They first consumed the plantations around the villages; and then entering the towns and villages devoured the victuals, &c., in the markets and streets, by degrees forcing themselves into the houses, and covering the walls outside as well as inside. Everything which was moistened by their saliva was poisoned, and the cattle that fed on the remnants which were left all died.

The devastation at Jaffa was equally great. The Locusts as they advanced were met by labourers employed to keep them off, to drive them away, or bury them, but they found that (Joel describes them, chap. ii. v. 7,) they could not "break their ranks," or rather, as soon as they were broken, they closed up again. The writer at Jaffa states that in one day his entire garden of eight acres was covered, and 3,000 trees were stripped of their leaves and fruit. Pleasure gardens, flowers, and vineyards, and even poisonous plants did not escape. The Locusts invaded the house, climbing the wall "like a mighty man" (Joel ii. 7), and the noise of them within the house was "like the noise of armed hosts," or the running of many waters.

ADDENDA.

ANIMALS AT GREAT DEPTHS OF THE SEA.

(*See pp.* 3 *and* 65.)

As SUPPLEMENTARY to the observations at these pages upon this curious inquiry, the following remarks, which occur in the account of the recent attempts to lay the Atlantic Telegraph Cable, (August, 1865,) will be read with great interest: they are quoted from the *Fortnightly Review*:

When the substance called Ooze came up on the grapnel-line of the *Great Eastern*, from a depth of nearly two miles, it was simply a light-coloured mud, like that which a heavy shower makes in the streets of London. Mr. Ward, surgeon of the vessel, got a very small shellfish, just visible to the naked eye, from the grapnel-line, which, on examination under a feeble microscope, looked like a young barnacle, and gave signs of life, but we had no *savans* among us. Whether he came up direct *de profundis*, or was a young truant wandering from his numerous family on the ship's bottom, is questionable, but the weight of opinion was in favour of the latter supposition. The Ooze, as it is called, under the same scrutiny presented none of the shells of which microscopists say it is altogether composed. Nay, they pretend to have found the fish in them still preserved by the natural pickle of the sea, which has made an ingenious gentleman advance the horrible theory that all the dead men who have been thrown overboard in their shotted hammocks are standing bolt upright and perfectly fresh at the bottom of the sea, like an army waiting for the order to march. What seemed to us all sand and gravel was to Ehrenberg and other microscopists *foraminiferæ* and *distomaceæ*—shells of exquisite fineness, showing conclusively by their perfection of outline that no currents or agitation of water exist in the place whence they come.

But it is further contended that these creatures, when alive, could not have inhabited these depths because the pressure would have been too great; and then one is launched on a sea of conjecture to decide how they were ever brought there, and how they

floated in myriads of millions—which no words or formulæ can express—on the surface waters, and sank down to form slabs of organic remains of impenetrable depth and unknown extent beneath. Not a trace of any mineral substance can be found, it is averred, in these illimitable submarine prairies. The cable may then rest undisturbed here if these be all there is to fear; for there is no current and no teredo to warp its course and eat through the hempen covering of the wire, which suffers much in other seas. But as a mite would in all probability never have been sent but for the invention of cheese, so it may be that there is some undeveloped creation waiting *perdu* for the first piece of gutta-percha which comes down to arouse his faculty and fulfil his functions of life—a gutta-percha boring and eating teredo, who has been waiting for his meal since the beginning of the world. As to sharks, the only remark that one can make is, that no instance has yet occurred of a cable being injured by a fish of any kind. Porpoises, grampuses, black fish, and whales fly from it, so that the cable under water is much better off than the wire on land in India and other places, where the monkeys are persuaded the poles and lines are erected for their special benefit, and elephants use the fences as scratching-posts.

At the Meeting of the British Association for the Advancement of Science, held at Birmingham, in September, 1865, the following communications upon the subject of Deep-sea Fishes were read.

A few Notes on the Voracity of the Chiasmodon, were communicated by Dr. Carle, F.L.S., accompanying a specimen received from Dr. Imray, of Dominica, by Sir Leopold M'Clintock. A small fish, with teeth inclined backwards, swallowed a very much larger fish and, whilst helplessly floating, was picked up. The swallowed fish was dead, the swallower yet alive. The abdominal integument has been stretched enormously, and is as thin as goldbeater's skin, but quite perfect. The lesser fish is of the genus Chiasmodon. The length of the swallower is 6⅝ in., and of the swallowed fish 10½ in.

Dr. Gunther, in the discussion which followed, stated there to be only two other specimens of the above fish. They are always found at a depth from 300 to 400 fathoms, and only five or six species are known. The most extraordinary characteristic of all these Deep-sea Fishes is, that all of them have the stomach ex-

tremely extensible; and in two other cases, for instance, saccopharynx, which have been caught in the middle of the Atlantic Ocean, and in the species caught by Johnson, at Madrid, a similar expansion of the stomach has been observed, but it was far inferior to that seen in the specimens present. Another peculiarity in these Deep-sea Fishes is the looseness with which the single bones are connected—in fact, many of these fish when brought to the surface fall to pieces. The great pressure of the water under which these fish are continually resting held the single parts together, and the cellular tissues are far more feeble than in fishes living nearer the surface of the water. Mr. Lowe, when fishing at a depth of 300 or 500 fathoms, has drawn up a piece of jaw and a piece of the head, the rest having gone as the fish approached the surface of the water. The specimen swallowed by this fish is also a rare specimen. Fifty years ago we had no idea that fishes were able to live at more than a hundred fathoms in depth, and it is only by recent discoveries that these fishes have been made known. There are only seven or eight families, and they have all the same peculiarity in the construction of their stomachs and in the organs of deglutition and digestion. Singular enough, they all belong to different families.

STORY OF THE BIG BIRD OF NEW ZEALAND.

(*See pp.* 279—297.)

By the ship *Ravenscraig*, arriving from New Zealand in the middle of October, 1865, Reports were brought of an Egg of the Moa, or Dinornis, alleged to have been discovered under these circumstances. Whilst some labourers were marking out a site to build upon in the Wairakie district a pick struck upon a cave. On opening it, it was found to contain the skeleton of a Maori in a crouching position, with both hands on the egg, and in such a manner as if death came upon the unfortunate native while in the act of partaking of the contents of the egg. Although the shell is slightly broken the gigantic proportions of the egg yet remain perfect. It measures about nine inches in length and seven inches in diameter.

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THE END.

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